

THE PHILIPPINE JOURNAL OF SCIENCE

VOL. 65

JANUARY-FEBRUARY, 1938

Nos. 1-2

PHILIPPINE MUSHROOMS

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SEVENTY-NINE PLATES AND FIVE TEXT FIGURES

INTRODUCTION

The mushroom from time immemorial has been considered one of the delicacies of the table. According to classic literature, Roman aristocrats prepared their own mushroom dishes, and in eating them used only amber knives and silver service. The following epigram shows the esteem in which the mushroom was held among the Romans as food: "Gold and silver and dresses may be trusted to a messenger but not boleti." History tells us that a fungus called "Caesar's mushroom" (*Amanita cæsaria*), said to be one of the most delicious, was seasoned by his wife, Agripina, herself, for the last meal of the Roman Emperor Claudius. The Chinese have long been known to be very fond of the mushroom. It is present in practically all their dishes. Mushroom culture among the Chinese has been known for centuries, and dried mushrooms have been brought from China to the Philippines in large quantities.

In the Philippines mushrooms are becoming popular as an article of diet. Interest in mushrooms as food is shown by the number of people who collect them wild for the table, and by the increasing number of inquiries received at the Bureau of Science. Unfortunately lack of familiarity with the different types of mushrooms has given rise to cases of mushroom poisoning in Manila and in the provinces. This work has, therefore, been prepared in response to inquiries received

by the author, and as a guide in distinguishing edible from poisonous mushrooms.

To enhance the practical value of this work, the author has taken pains to keep it within the understanding of the layman. Technical terms are used only whenever their replacement by popular expressions would jeopardize scientific accuracy. Moreover, considerable help can be obtained from the glossary.

The descriptions, together with the corresponding photographs and drawings here presented, should enable anyone to identify the different kinds of mushrooms commonly found; and it is hoped that this work will prove useful to those more seriously interested in the study of mushrooms.

ACKNOWLEDGMENT

The writer acknowledges his obligation to Dr. Eduardo Quisumbing, chief of the National Museum Division, Bureau of Science, for his criticisms and suggestions, and for reviewing the work. To Mrs. Simeona Leus-Palo the author is much indebted for valuable assistance in working out and recording microscopic details for the identification of several of the mushrooms that are here described. The author is also indebted to Mr. Victorino V. Marasigan, chief scientific illustrator of the National Museum, and to Messrs. Ricardo C. Aguilar, Hernando T. Castelo, and Miss Remedios R. Ico, artists of the National Museum Division, Bureau of Science, for the skill and accuracy with which they have prepared the line drawings in this paper. To the personnel of the Photographic Division, Bureau of Science, the author is grateful, especially to Mr. Domingo Farol, who accompanied the author on his many field investigations and who took photographs of specimens in their natural habitat. To Dr. C. L. Shear, senior plant pathologist of the United States Department of Agriculture, the writer tenders his gratitude for sending several specimens of agarics.

GLOSSARY

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| ABERRANT. Differing from the customary structure of related groups. | ADNEXED. Attached to the stem only at the upper corner. |
| ACRID. Biting to the taste. | ADRESSED. In close contact, but not joined. |
| ACUMINATE. Tapering to a point. | ANALOGY. Resemblance in certain respects only, not in the plan of structure. |
| ADHERENT. Grown to or sticking to. | |
| ADNATE. Attached squarely to the stem. | |

- ANASTOMOSING. Running together irregularly.
- ANNULUS. Ring formed on the stem by the inner veil.
- APEX. Opposite to the point of attachment (the top).
- APICULATE. Ending in a little point.
- APPENDICULATE. Hanging in small fragments.
- APPROXIMATE. Gills approaching to, but not actually touching the stem.
- ASCUS, pl. ASCI. The spore-bearing structure in Ascomycetes.
- BASIDIUM, pl. BASIDIA. The spore-bearing structure in Basidiomycetes.
- BI-, BIS-. In combined words, meaning 'twice.'
- BIENNIAL. Growing one year, flowering or fruiting the succeeding year; of two years' duration.
- BIFID. Divided halfway into two.
- CÆSPITOSE. Growing in tufts like grass.
- CAMPANULATE. Bell-shaped.
- CANALICULATE. With a longitudinal channel or groove.
- CAPILLARY. Threadlike.
- CAPITATE. Having a head.
- CARTILAGINOUS. Tough-brittle. Breaking with a snap like a piece of cartilage.
- CILIATE. Fringed with hairs.
- CLAVATE. Club-shaped.
- CONFLUENT. Meeting or coming together.
- CONIDIUM, pl. CONIDIA. An asexual spore.
- CONNIVENT. Coming into contact or convergent.
- CORACEOUS. Leathery.
- CORTEX. The outer skin.
- CORTINA. A veil of spiderweblike structure.
- CRUSTACEOUS. Of brittle texture.
- CUTICLE. The outer skin.
- CYATHIFORM. Cup-shaped.
- CYSTIDIUM, pl. CYSTIDIA. A sterile cell, often inflated, projecting beyond the basidia and paraphyses in the hymenium of Basidiomycetes.
- DECIDUOUS. Falling or subject to fall, in season.
- DECURRENT. Gills running down the stem.
- DELIQUESCENT. Becoming fluid when mature.
- DENTATE. Toothed.
- DEPRESSED. Sunken.
- DICHOTOMOUS. Forking in pairs.
- DISCOLORED. Of a different color.
- DISTANT. Separated by wide spaces.
- ECCENTRIC. One-sided.
- ECHINULATE. With short bristles.
- EFFUSED. Expanded.
- EMARGINATE. With a sudden curve as if scooped out.
- ENDOGENOUS. Produced inside another body.
- ENDOPERIDIUM. The inner layer of the peridium.
- EPIPHYTE. A plant which grows upon other plants but not parasitically.
- ERUMPENT. Bursting through the surface of the substratum.
- EVANESCENT. Lasting only a short time.
- EXOGENOUS. Produced on the outside of another body.
- EXOPERIDIUM. The outer layer of the peridium in the Gasteromycetes.
- FACULTATIVE. Occasional, incidental, as opposed to obligate.
- FARINOSE. Covered with a white mealy powder.
- FASCICULATE. Growing in bundles.
- FERRUGINOUS. Of the color of iron rust.
- FIBRILLOSE. Clothed with small fibers.
- FILIFORM. Threadlike.
- FIMBRIATE. Fringed.
- FISTULOSE. Hollow, like a pipe.
- FREE. Reaching the stem but not attached to it.
- FURCATE. Forked.
- FUSIFORM. Spindle-shaped.
- GILLS. The lamellæ or plates which bear the hymenium in Agaricaceæ.
- GLABROUS. Smooth, not hairy.
- GLEBA. The internal tissue in Gasteromycetes and Tubercaceæ.

- GREGARIOUS. Growing in company.
- GROOVE. A furrow, channel.
- HABIT. The general appearance.
- HABITAT. The place of growth.
- HETEROGENEOUS. Not uniform in structure.
- HOMOGENEOUS. Uniform in structure.
- HOST. Plant or animal on or in which a parasitic fungus exists.
- HYALINE. Colorless, translucent.
- HYMENIUM. The layer composed of the spore-bearing organs.
- HYPHA, pl. HYPHÆ. The threadlike element of which fungi are composed.
- IMMARGINATE. Without a distinct border.
- INDEHISCENT. Not splitting when ripe; not opening in a definite manner.
- INFERIOR. Low down on the stem.
- INFUNDIBULIFORM. Funnel-shaped.
- INNATE. Adhering by growing into.
- INVOLUTE. Rolled inward.
- LAMELLA, pl. LAMELLÆ. The gill or plate which in Agaricaceæ bears the hymenium.
- LATEX. The fluid or "milk" present in the cells of certain fungi.
- LURID or LIVID. Discolored.
- MARGINATE. Having a distinct border.
- MATRIX. The substance upon which a fungus grows.
- MEMBRANOUS, MEMBRANACEOUS. Thin and semitransparent.
- MULTI. Many.
- MYCELIUM. Spawn; vegetable hypha.
- MYCOLOGY. The study of fungi.
- NODULOSE. Having nodules, or small knobs or knots.
- OB-, prefix. Inversely or oppositely.
- OBCONIC. Inversely conical.
- OBLONG. Considerably longer than broad, and with nearly parallel sides.
- OBOVATE. Inversely ovate.
- OBSOLETE. Wanting or rudimentary.
- OBTUSE. Blunt or round at the end.
- OCHREOUS. Like yellow, not red, ochre.
- OPAQUE. Mostly used in the sense of dull, not shining.
- OPERCULUM. A cover.
- ORBICULAR. Circular; flat, with a circular outline.
- OSTIOLE. The aperture through which the spores escape in certain genera.
- OVATE, OVOID. Egg-shaped.
- PALMATE. Lobed in a fingerlike manner.
- PAPILLA. A nipplelike elevation.
- PARAPHYSIS, pl. PARAPHYSES. Sterile filaments in a hymenium.
- PARTIAL. Extending from the margin of the cap to the stem.
- PEDICEL. A small stalk.
- PERIDIOLUM. The rounded bodies in Nidulariaceæ (Bird's nest).
- PERENNIAL. A plant that continues to live from year to year.
- PERIDIUM. The outer cover investing the gleba in Gasteromycetes, as in puffballs.
- PERITHECIUM, pl. PERITHECIA. The flask-shaped structure which in Ascomycetes contains the asci.
- PILEATE. Having a cap or pileus.
- PILIUS. The cap structure bearing the hymenium in Agaricaceæ.
- PLANE. Even, flat.
- PLICATE. Folded into plaits.
- PLUR-, PLURI-. Used as a prefix for 'many,' or 'several.'
- POLY-. Many.
- PORES. Openings or orifices for the escape of the spores.
- POROUS. Equipped with pores.
- RADIATE. Spreading from a center.
- RECEPTACLE. An axis bearing one or more organs, as the stem in the phalloids; also used for any hymenium-bearing structure.
- REMOTE. The position of the gills when they do not reach the stalk but leave a free space around it.

- RHIZOMORPH.** A rootlike strand of compacted mycelium.
- RUDIMENT.** The earliest condition of an organ.
- SCLEROTIUM.** A compact mass of hyphæ in a dormant state.
- SCURF.** Thin dry scales or scabs.
- SEPTATE.** Having divisions or partitions.
- SERRATE.** Notched or toothed on the edge.
- SIMPLE.** Unbroken; unbranched; undivided.
- SINUATE.** Gills that are notched near the stem.
- SPORES.** The analogues of seeds in flowering plants.
- SPOROPHORE.** The fruit body.
- SQUAMOSE.** Scaly.
- STELLATE.** Star-shaped.
- STERIGMA, pl. STERIGMATA.** The portion of the basidium-bearing spores.
- STIPE.** A stalk.
- STIPITATE.** Having a stalk or stem.
- STRIATE.** Marked with fine lines, grooves, or ridges.
- STROMA.** A cushionlike body in which the perithecia are immersed in many Ascomycetes.
- STUFFED.** The condition of the stem in which the interior is filled with a substance of a texture different from that of the walls.
- SUB-,** prefix. 'Under,' 'below,' or 'partly.'
- SULCATE.** Marked with grooves.
- SUPERIOR.** Annulus or ring that is near the apex of the stem.
- SYNONYM.** A superseded or unused name.
- TAWNY.** Of a dull yellowish-brown color.
- TRAMA.** The tissue between the hymenium in gills.
- TRUNCATE.** Ending abruptly as though cut off at the end.
- TUBERCLE.** A small wartlike protuberance.
- TURBINATE.** Top-shaped.
- UMBILICATE.** With a small central depression.
- UMBO.** A central elevation of the pileus.
- UMBONATE.** Having an umbo.
- UNIVERSAL.** A term applied to the volva or veil which completely envelopes some fungi when young.
- VEIL.** The outer envelope in the Agaricaceæ within which development takes places.
- VENOSE.** Having veins.
- VERRUCOSE.** Warty.
- VESICULOSE.** As if composed of bladders.
- VISCID.** Clammy; sticky.
- VOLVA.** The tissue enveloping the young sporophore usually ruptured at the apex, leaving a cup-shaped structure at the base of the stem.
- ZONE.** A girdle.

MUSHROOMS AND TOADSTOOLS

The question is often asked: "How can the mushroom be distinguished from the toadstool?" The answer is simple enough: There is no difference between these two groups of fungi. A fungus with a fleshy, tough, or jellylike fruit body that can be studied with the naked eye is called mushroom. A stool-shaped mushroom is called a toadstool. By inference the word toadstool has come to mean a poisonous fungus, and the word mushroom, an ordinary field agaric. Such a definition leaves out varieties that are neither toadstools nor mushrooms. To avoid confusion, a better usage is suggested, in which "toadstool" and "mushroom" are synonymous.

The Philippine Islands are extremely rich in fungi, especially the mushroom group. The question of vital importance now is not how to distinguish the mushroom from the toadstool or vice versa, but how to distinguish between mushrooms that are poisonous and those that are edible, in order to avoid eating the poisonous kinds.

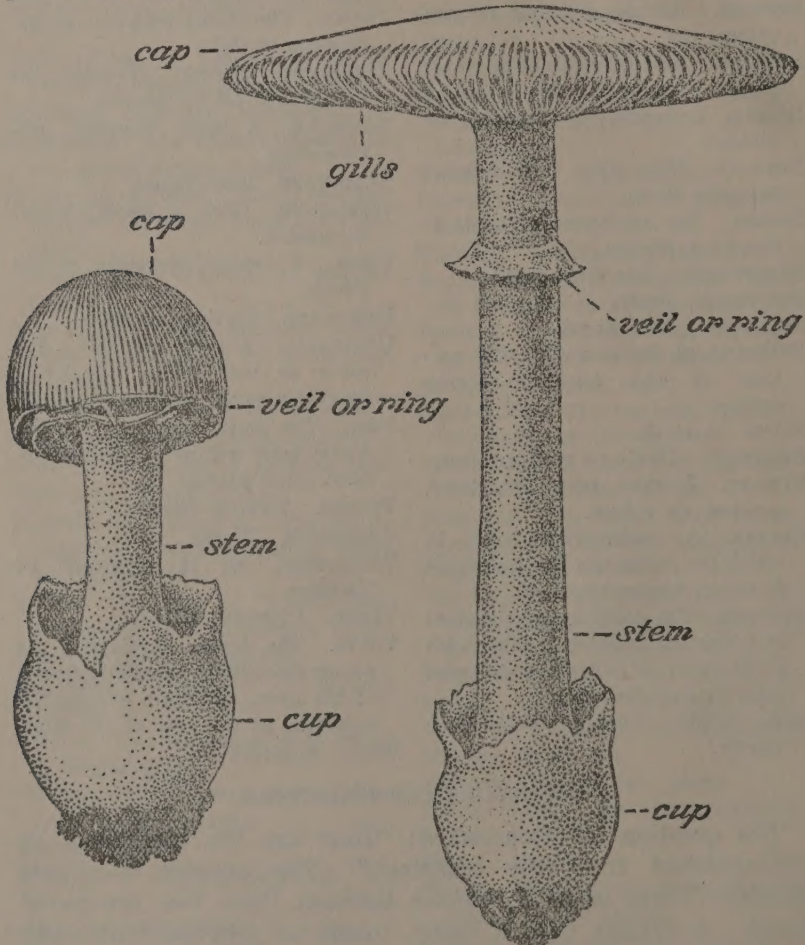


FIG. 1. Structure of a gill mushroom.

Gill mushrooms.—The structure of a gill mushroom (text fig. 1) consists of the stem, or *stipe*; the cap, technically called *pileus*, which is the expanded portion at the top; the gills, or *lamellæ*; a cuplike structure at the base of the stem, called *volva*; the veil covering the gills; and a ring, or *annulus*, just

on top or at the center of the stem. In some mushrooms the ring or the cup, or both, are present. In the genus *Amanita* (Plate 12) the cup and the ring are present. In *Lepiota* (Plates 14 and 17) and *Psalliota* (Plates 47 to 50) the ring is present,

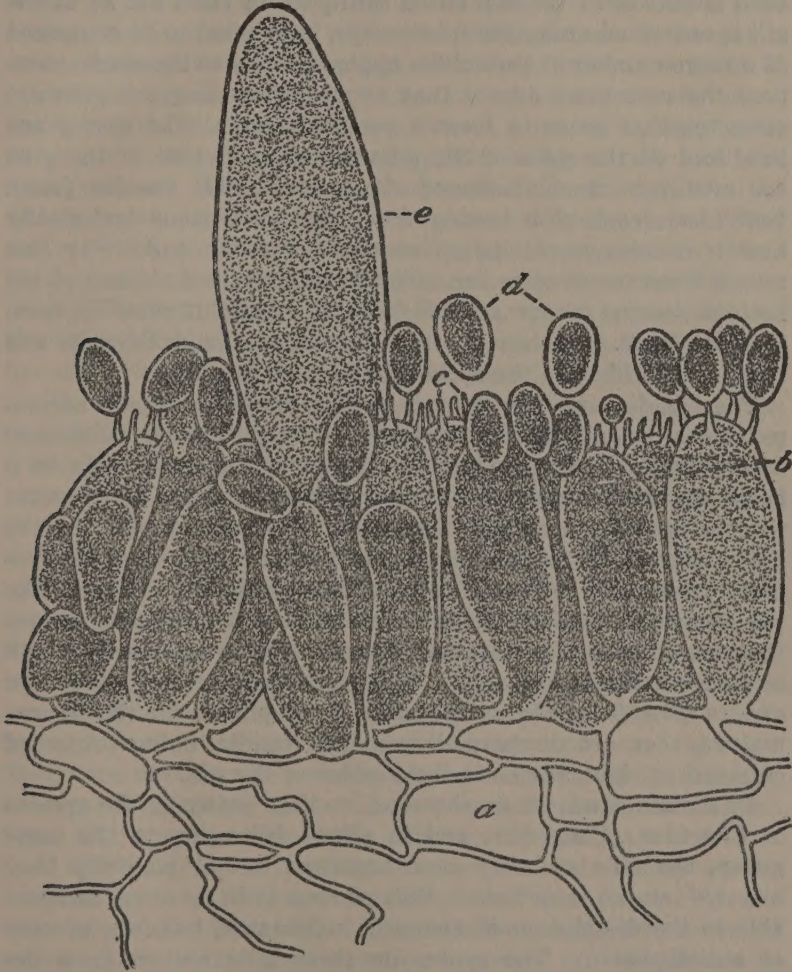


FIG. 2. Cross section of a very small portion of a gill, showing a, hyphae; b, basidia; c, sterigmata; d, spores; e, cystidium; highly magnified.

while in *Volvaria* (Plate 42) the ring is absent but the volva is present. In the case of *Collybia* (Plate 23) the ring and the volva are absent. On the underside of the cap are found the gills, or lamellæ. They appear as thin bladelike structures, extending from the stem to the margin of the cap in some mush-

rooms, while in others they extend further out off the margin. In some species the long gills alternate with the short ones. The cap is covered on the underside with a delicate membrane, called the veil. The veil is prominently seen in the early stages, but soon breaks off. When a sliced thin portion (text fig. 2) of the gill is examined under the microscope, it is found to be composed of a large number of threadlike hyphæ similar to those that compose the mycelium, except that hyphæ composing the gills are close together so as to form a compact body. The spores are produced on the sides of the gills. Certain hyphæ of the gills are modified into club-shaped structures, called *basidia* (sing. *basidium*), each club having four tiny projections technically known as *sterigmata* (sing. *sterigma*) at the end. For this reason these mushrooms are called Basidiomycetes. Some of the basidia become larger at the end and extend further to form *cystidia* (sing. *cystidium*). These serve to stretch the gills and thus tend to liberate the spores much more readily.

The basidia are very minute, and a small space can accommodate a large quantity of them. The gills of a mushroom accommodate numerous basidia. Each of the sterigmata in a basidium bears a spore. The spores vary in shape from round to oval, and from smooth to spiny. Professor Buller, of the University of Manitoba, found that a single individual of *Psalliota campestris* produces about 1,800,000 spores. Others, like the simple puffball, produce as many as 7,000,000,000 spores. But not all spores germinate, otherwise the whole earth would be covered with mushrooms. It is estimated that not more than one in 20,000 spores succeeds in developing. As the spores mature, they are discharged from the basidia, being projected outward at right angles to the surface of the gill.

In certain kinds of mushrooms, such as many of the species of *Coprinus* (Plate 52), and in others belonging to the same group, the gills are very close together, but at maturity they dissolve into an inky fluid. This process is in no sense comparable to the dissolution of chemical substances, but is a process of autodigestion. The spores on these gills mature in a definite order. Those that are at the lower end of the gills mature first, followed by others in succession upward. As the cap begins to open in bell-shaped form, the lower ends of the gills are slightly separated from each other. There the spores mature and fall. At once autodigestion sets in and removes the now useless parts of the gills, thus leaving a clear path for

the fall of the spores from higher up. This continues until all the spores have fallen and the gills have entirely dissolved.

There are two stages; namely, the vegetative or the growing stage of the mushroom, and the fruiting stage. The former, which is the *mycelial* stage, is equivalent to the common term *spawn* in the mushroom, while the fruiting stage is the mushroom stage. Mushroom spawn, therefore, takes the form of strands of mycelium (Plate 1, fig. 3), which are usually interlaced into definite threads, each thread growing by increasing in length at the end. The thread grows independently and even branches out. The strands of mycelium which constitute the spawn grow rapidly under favorable conditions, but if they are retarded, it takes weeks, months, and even years for them to mature and to produce mushrooms. In countries like the United States and some parts of Europe, where mushrooms are grown artificially, commercial spawn is used. It is sold in bottle- and brick-shaped forms (Plate 1, figs. 1 and 2).

Other types of mushrooms.—So far we have been dealing only with the gill type of mushrooms. There are, however, a number of types of fungi that are just as truly mushrooms, among which are a large number of shelflike mushrooms that do not have gills at all, but, instead, on the under side of the shelf a large number of little pores or tubes (Plate 55). The spores are produced on the inner surface of these tubes. They are produced on the basidia, just as in the gill fungi, so that the inner surface of the tubes, sufficiently magnified, looks very much like the surface of the gill. Many of these pore fungi are woody or leathery and tough, and therefore not good to eat; but a few of them are fleshy and tender and very palatable. There are also a large number of umbrella-shaped fungi which have pores instead of gills. These are mostly fleshy and tender. Some of them are edible, while others are poisonous.

A number of other mushrooms produce their spores on the basidia. Among them are the hedgehog fungi (Plate 59) and the club fungi (Plate 60). The hedgehog fungi are so called because they bear many spinelike branches on the surface of which the spores are produced. These species always hang downward, no matter in what position the fungus is growing; this fact serves to distinguish them from the club fungi, since in the latter the branches always project upward.

Another important group of mushrooms is the puffball group (Plate 70). The spores of a puffball are produced on the basidia which are scattered through the greater part of the interior

of the mushroom, and when they are mature they can easily be puffed out by pressing on the sides of the puffball.

All mushrooms so far mentioned produce their spores on the basidia and are, therefore, Basidiomycetes. There is another very large group of fungi, which includes a few mushrooms and produces its spores in a very different way. These are the sac fungi, or Ascomycetes, so called because their spores are produced within little saclike structures. Most of the sac fungi have small fruit bodies, and grow as parasites on other plants. They are very important as causes of plant diseases; they are not mushrooms, except a few that are large enough to be studied without the aid of a microscope. Familiar examples of mushrooms belonging to this group are: *Morchella esculenta* (Plate 74, fig. 1), *Peziza sulcipes* (Plate 75, fig. 1), and *Xylaria dealbata* (Plate 77, fig. 2). These sac mushrooms discharge the spores forcibly, the eight spores in a sac being hurled in a cluster. Usually a considerable number of sacs discharge their spores at the same time, and then it is several minutes before others are discharged, so that at periodic intervals a cloud of spores may be seen issuing from the fruit body.

Another very interesting group of mushrooms are the stink-horns (Plates 64 to 69). The spores of these fungi are sticky and are deposited in a mass on an exposed portion of the body. From this mass of spores emanates a fœtid odor that attracts insects, especially flies. The spores attach to the feet of the insects and are carried away in this manner.

Development of mushrooms from the button stage.—Since the spawn is the vegetative, or the growing stage of the mushroom, it develops through the substratum or host on which the strands grow. When the mushroom or fruiting stage begins, small knots, or buttons, appear on these strands. This stage is known as the button stage (Plate 2). At first these knots appear as tiny dots, developing from the size of a pinhead to that of a pea, or even larger; later they elongate, while the end becomes larger. At this period the main parts of the mushroom—the stem and the cap—begin to be more distinct.

The substratum.—The substratum here is the material on which a fungus grows, whether it be soil, bark, wood, dead leaves, a living tree, or some other material. Every mushroom lives on some kind of substratum. Many of them, however, are limited to certain definite kinds. Some species, for instance, grow only on dung, or on soil that is rich in humus; others, like

to grow on dead wood; while still others thrive on meadows and lawns.

Light requirement of mushrooms.—Most fungi grow better in the dark than in the light; others grow only in the shade; while still others grow only in the open sunny places. Obviously, then, some mushrooms require only a certain amount of light. Some are able to live very well in the dark, but fail to produce fruiting bodies. In caves, and in abandoned mines, or tunnels, where there is no light, *Psalliota campestris* is grown commercially.

Water requirement of mushrooms.—The notion, based on superficial observation, that mushrooms require a great deal of water, holds true for many fungi, but not for all. The shelving fungi (Plate 57), for example, require very little water. Most mushrooms require an abundance of water for the development of their fruiting bodies, but they do not flourish in places that are continuously saturated with water. Most mushrooms develop fruiting bodies only during the wet season. A single downpour of rain during the dry season does not bring a good crop of mushrooms; a shower must be followed within one or two days by another shower for the fruiting bodies to develop.

Animals in relation to mushrooms.—There are a number of ways in which animals affect the life of mushrooms. Chief among these is the destruction of the fruiting bodies. Many animals feed upon mushrooms. Carabaos, cattle, sheep, and goats are very fond of certain kinds, especially the large puff-balls. Rats are very fond of mushrooms when they are still in the button stage. In mushroom culture these rodents are often the cause of failure. Slugs and crickets habitually feed upon various kinds of mushrooms. In mushroom beds the most destructive animals are the maggots, the young of small flies or gnats. They bore into the mushroom and riddle it in a short time. Mushroom mites are sometimes troublesome; these multiply very rapidly.

A very interesting mushroom is *Collybia albuminosa*, which has the habit of growing on or near ant hills. There is a certain substance excreted by ants that stimulates the appearance of this mushroom. Because of its habit to grow from termite nests, this mushroom is sometimes called termite fungus. In certain tropical countries, not excluding the Philippine Islands, a very interesting interrelation of mushrooms and animals is presented by the leaf-cutting ants. These carry pieces of leaves

from some trees on their back to a suitable place. The pieces of leaves are chewed to a pulp and spread out. On this, they plant the mycelium of a mushroom, and in a few days under favorable conditions mushrooms grow. These ants take good care of their gardens, weeding out undesirable fungi and in return obtaining an abundant supply of food. The mushroom they cultivate is *Rozites gemylophora*, one of the umbrella types of gill fungi.

Parasitic and saprophytic mushrooms.—A great number of mushrooms are destructive parasites. In many trees heart rot is caused by the growth of the penetrating mycelium of some fungi. *Armillaria mellea* (Plate 22, fig. 1) which is one of the worst parasites, even attacks living trees, ultimately causing death. Many of the bracket types (Plate 57) and the oyster mushrooms, like *Pleurotus* (Plate 3), attack roots and trunks of trees. Some mushrooms live as parasites on other mushrooms. A great many of the wood-destroying fungi are parasitic for a part of their lives, and become saprophytic later. Once they have gained entrance into a tree through a wound, they begin to develop, and when the tree is killed, they continue to live on it. Others exist as saprophytes, living entirely on dead wood (Plate 4). Many of the *Lentinus* belong to this type of mushrooms.

The fairy rings.—Fairy rings are more or less circular forms of mushrooms or toadstools (Plate 5). They are easily recognized in fields, lawns, or grassy places. All over the world, including the Philippines, fairy rings are connected with superstitious beliefs that vary in different countries. In the Philippines it is a common belief that fairy rings mark the path of dancing fairies and that they bring good luck to the people that live near them. In France, however, the peasants are afraid to enter these rings because they believe that huge toads that are apt to injure men are to be found there. In Germany, country folks believe that the center of the ring marks the place where an enormous dragon has rested the previous night. Even in scientific circles it was formerly believed that thunder, lightning, whirlwinds, ants, or animal urine cause the formation of fairy rings, until 1796, when Withering discovered that *Marasmius oreades* is responsible for the fairy-ring formation. Later many scientists followed up this problem and ultimately came to the same conclusion; namely, that fairy rings are caused by the

growth and habit of certain mushrooms, and have no connection whatsoever with any supernatural influences.

Fairy rings are formed by the mycelium that starts from a single spore. This mycelial growth extends in all directions, forming a circular periphery at which mushrooms spring up. Outward from the center the mycelium dies off, after using up the organic matter in the soil, while at the periphery it grows luxuriantly, because the soil there is still rich with food materials. Every year, as fresh organic matter becomes available, the mycelium continues its outward growth, retaining its circular margin, so that another crop of mushrooms springs from the periphery as before, leaving behind the dead mycelium as previously. In this way the ring increases in diameter year after year. The decayed mycelial materials are naturally rich in organic matter, and it is said that fairy rings could continue growing for many years, even for centuries.

In countries outside the Philippines about 100 species of mushrooms are reported to form fairy rings. A few are *Lepiota chlorospora*, *Marasmius oreades*, and *Psalliota silvicola*. Copeland reported in 1905 that *Psalliota perfuscus* forms a ring in the Philippines. Two mushrooms, *Lepiota cepaestipes* and *Calvatia lilacina*, were also observed to form fairy rings in this country.

Common belief about mushrooms in relation to thunder.—It is a common belief in the Philippines that thunder and lightning have something to do with the spontaneous appearance of mushrooms. When thunder begins to rumble, especially during May or early June, at the start of the rainy season, young and old in rural communities rush out to the open fields and meadows in search for mushrooms. A heavy rain occurring at night and accompanied by loud thunder is said to be a sure sign that mushrooms will appear the next morning. Of course, moisture is essential to the development of mushrooms. Before or during the early part of the rainy season the days are warm, and naturally during downpours the atmosphere is full of electrical charges, causing thunder and lightning. This phenomenon gives rise to the belief that thunder and lightning are responsible for the spontaneous appearance of mushrooms in the fields and meadows.

Luminosity in mushrooms.—Luminosity in some mushrooms has long been known by men. Past writings have stated that

people gathered certain luminous mushrooms and put them in appropriate places to guide their ways at night in the forest. In places where there is danger from fire, or where grain, corn, and the like are stored, luminous mushrooms were used as illumination. Even the mycelium of such mushrooms is luminous, and the wood that is attacked by this kind of fungi also emanates light. In the Philippines people are familiar with the luminosity of some fungi. Most common among these are the species of *Pleurotus* (Plates 29 to 31). They are called *anandap* in Ilocano and *alitaptap*¹ in Tagalog. The luminosity of some of these mushrooms would also help to distinguish one species from another. Among the mushrooms besides the many species of *Pleurotus* reported to emanate light are: *Armillaria mellea*, some species of *Xylaria*, and several of *Fomes*.

Native names of Philippine mushrooms.—In the Tagalog provinces the general name for edible mushrooms is *kabute*, derived from the Tagalog word *kabutihan*.² Common names are applied to particular forms, often according to the place in which they are produced, and sometimes according to the outstanding characters of the mushrooms themselves. *Kabuteng punso*³ is the name given to *Collybia albuminosa*, because of the habit of this mushroom to grow on or near ant hills. *Volvaria esculenta* is given the name *kabuteng ginikan*, because of its habit of growing on rotten palay straw. The fanlike mushrooms of the genus *Pleurotus* are called *anandap* in Ilocano and *alitaptap* in Tagalog, because of the phosphorescence given off by them at night. The puffballs are called *paraqara*⁴ in Ilocano, because of their likeness to the embryo of the coconut. *Bakui*, *kulat*, or *kuat* are terms applied to rather leathery fungi in Tagalog. The word for mushroom in Negros Occidental and Panay is *ohong*; in Leyte, *ulaping*; in Pangasinan and Ilocano Provinces, *oong*; in Bicolano, *tobó* or *tigboq*; in Cagayan and Isabela, *karulu*;⁵ and in Zambal, *dakaakan*. In Pampanga the ordinary umbrellalike mushroom is called *payungpayunġan*. *Balugbug daguis*⁶ is the name given to *Auricularia* in Pampanga; *taiġgang-daga* in Tagalog, *taiġga ti otot* in Kalinga, and in Negros Occidental and Panay the members of this genus are called *dolongan sang kahoy*.⁷

¹ Firefly.² Goodness.³ Mushroom on the ant hill.⁴ Embryo of the coconut.⁵ Umbrellalike.⁶ Rat's ear.⁷ Ear on the wood.

THE MUSHROOM AND ITS RELATION TO MAN

Poisonous mushrooms.—Poisonous mushrooms were known even before the Christian era. The Romans associated poisonous serpents and fungi in their minds. Pliny writes:

Noxious kinds must be entirely condemned; for if there be near them a hobnail or a bit of rusty iron or a piece of cotton cloth, forwith the plant, as it grows, elaborates the foreign juice and flavors into poison; and country folk and those who gather them are alone able to discern the different kinds. Moreover they imbibe other noxious qualities besides; if, for instance the hole of a venomous serpent be near and the serpent breathe upon them as they open from their natural affinity with poisonous substances, they are readily disposed to imbibe such poison. Therefore we must notice the time before the serpents have retired into their holes.

An epigram attributed to Martial on the death of Macrinus, says: "You were wont to deny, Macrinus, that men could be killed by fungi; yet Boleti were the cause of your death."

In the Philippines the people in rural communities believe that mushrooms growing on animal dung and those that have white rings are poisonous or at least not edible. They are very cautious in collecting mushrooms in the woods for the table, especially those that are slightly colored. It is also a common belief that when a piece of garlic dipped in a cooked mushroom turns black, the mushroom is poisonous. To indicate the characters of the poisonous or nonedible mushrooms, descriptive names are given to them. For example, the Ilocanos call *Lepiota chlorospora*, a poisonous species, *oong ti takki nuañg*; ⁸ in Tagalog it is called *payong ahas*.⁹

Fortunately there have not been many cases of fatal poisoning in the Philippines from mushrooms. In fact the deadly poisonous species are rarely found in the lowlands. The deadly kinds, such as the species of *Amanita* that thrive in cold countries, are not met with, except in cool places in high mountains like Baguio, Mountain Province, and its vicinity.

Mushroom poisoning.—The question of toxicology of the higher fungi is of theoretical and practical importance. Unfortunately not much investigation has been accomplished so far, especially in the Philippines. A few toxic compounds, chiefly alkaloids, have been isolated from mushrooms, especially from *Amanita muscaria*, *A. phalloides*, *A. pantherina*, and other species of *Amanita*.

⁹ Mushroom on carabao dung.

⁸ Snake mushroom.

Choline.—Choline is an alkaloid of wide occurrence in the animal and vegetable kingdoms. It has been isolated from *Amanita muscaria*, *A. pantherina*, and several other higher fungi. It is said not to be very toxic, but combined with oxygen it passes over into *muscarine*. According to Kobert the remains of choline on the decay of the mushroom containing it is not muscarine but a very closely related alkaloid, *neurin*. Thus a comparatively harmless alkaloid is transformed into an extremely deadly one, simply by the partial decay of the plant in which the former is usually found. Neurin in its physiological effects is practically identical with muscarine, which is described below.

Muscarine.—Muscarine is the most dangerous alkaloid found in mushrooms. It is most abundant in *Amanita muscaria*, other species of *Amanita*, and some members of *Boletus* and *Russula*. It is probably identical with *bulbosine*, which was isolated from *Amanita phalloides* by Boudier. Muscarine is an extremely violent poison, 0.003 to 0.005 of a gram (0.06 grain) being highly toxic to man. Like other constituents of mushrooms, the amount of muscarine present varies very greatly with the varying conditions of soil and climate. According to Kobert, *Amanita muscaria* contains besides choline and muscarine, a third alkaloid, which he calls "pilz-atropin." This alkaloid, like ordinary atropine, neutralizes to a greater or lesser extent the muscarine. Fortunately muscarine has a very unpleasant taste. *Amanita muscaria* is said to be used by the inhabitants of northern Russia as a means of inducing intoxication. To overcome the extremely unpleasant taste of the plant they swallow pieces of the dried cap without chewing them, or boil them in water and drink the decoction with other substances which disguise the taste.

The symptoms of poisoning with muscarine through eating *Amanita muscaria* are not at once evident. They usually manifest themselves in from one-half to two hours. Vomiting and diarrhoea almost always occur, with a pronounced flow of saliva, suppression of urine, and various cerebral phenomena, such as giddiness, loss of confidence in one's ability to make ordinary movements, and derangement of vision. This condition is succeeded by stupor, cold sweat, and a very marked weakening of the heart's action. In cases of rapid recovery the stupor is of short duration and usually marked with mild delirium. In fatal cases it continues from one to two or three

days, and death at last occurs from the gradual weakening and final stoppage of the heart action.

Amanita muscaria must be definitely established as the cause of poisoning before the prognosis can be determined and proper treatment given. The treatment for poisoning by muscarine consists primarily in removing the unabsorbed portions of the mushroom from the alimentary canal and in counteracting the effect of muscarine on the heart. The action of this organ should be fortified at once by the subcutaneous injection, by a physician, of atropine in doses of from one one-hundredth to one-fiftieth of a grain. The strongest emetics, such as sulfate of zinc or amorphine, should be used, though in case of profound stupor even these may not produce the desired effect. Freshly ignited charcoal or two grains of a 1 per cent alkaline solution of permanganate of potash may then be administered, in order, in the case of the former substance, to absorb the poison, or, in the case of the latter, to decompose it. This treatment should be followed by oils or oleaginous purgatives, and the intestine should be cleaned and washed out with an enema of warm water and turpentine. The use of atropine to stimulate the heart that has already ceased to beat is indeed the means of saving numerous lives. Its use, therefore, should be pushed forward. *Phallin* may be present in *Amanita muscaria*. Symptoms of this poison should be looked for in the color of the blood serum discharged from the intestines.

Phallin.—Chemically this toxic substance is generally considered to be of an albuminous nature. It is so deadly that 0.0015 grain per 2 pounds live weight is a fatal dose for cats and dogs. It is the active principle of the most deadly of all mushrooms, *Amanita phalloides*, or death-cup fungus. (There are indications of the presence of this plant in Baguio, Mountain Province, and its vicinity.) Its effect is not, as in the case of muscarine, paralysis of the nerves controlling the action of the heart, but a rapid dissolution of the blood corpuscles, the blood serum escaping from the blood vessels into the alimentary canal, and the whole system being rapidly drained of its vitality. No bad taste warns the victim, nor do the preliminary symptoms begin until nine to fourteen hours after the poisonous mushrooms have been eaten. There is considerable abnormal pain, and there may be cramps in the legs and other nervous phenomena, such as convulsions, and even lockjaw or other kinds of tetanic symptoms. The pulse is weak, the abnormal pain

is rapidly followed by nausea, vomiting, and extreme diarrhœa, the intestinal discharges assuming the "rice-wash" condition characteristic of cholera. The latter symptoms are persistently maintained, generally without loss of consciousness, until death comes, in from two to four days.

There is no known antidote against phallin. Competent medical advice should be obtained as soon as possible. Active emetics, such as ipecac, mustard, apomorphine, assisted by the stomach tube, purgative (castor oil being preferable to the salines), should be administered at once, and every effort made to reduce further absorption of the poison to a minimum. High enemata to empty the lower bowel must be used early. Later normal saline solution may be given in the forms of enemata or even intravenously to supply the body's need for fluid and to ease the torturing thirst. Narcotics and anodynes in large doses are necessary to relieve the intense pain and to quiet convulsive movements. Nitroglycerine and strychnine given frequently and up to the limit of tolerance are of great value. Cyanosis calls for oxygen inhalation. Atropine may be used as a stimulant and a corrective with morphine, but it has no antidotal value here. Milk, raw or boiled, may be regarded as a mild natural antidote. Alcohol should probably not be given in any form. Strong coffee is indicated, as are hot dry applications to the body. Digitalis may be used, but shows no effects until six to ten hours later. Camphor in sterile oil given subcutaneously every hour is very helpful. Large draughts of hot water, flaxseed tea, or starch water, may be used, as well as tannigen, bismuth subcarbonate, and opium, to quiet the excessive diarrhœa and vomiting. Supportive measures and good nursing are of the greatest importance.

A number of minor poisonous species of mushrooms, like *Lepiota chlorospora*, *L. cepaestipes*, some *Panæolus*, and others, produce symptoms that resemble the action of muscarine. These species have not been given the importance and attention which they deserve. Fortunately they usually have an emetic action which prevents fatal consequences. Some of them are violent gastro-intestinal irritants and may thus add gravity to the illness. Death from them is almost unknown in healthy adults.

General rules to prevent mushroom poisoning.—There are no set rules for telling whether mushrooms are edible or poisonous. The only safe procedure is to know a mushroom before eating it. Such tests as "peels," or "blackens a silver coin when

cooked," are of no value. Some of these tests happen to apply also to edible mushrooms. The following rules may help to avoid mushroom poisoning:

1. Avoid fungi in the button or unexpanded stage, also those in which the flesh has begun to decay.

2. Avoid all fungi that have death cups, stalks with a smaller base surrounded by a saclike or scabby envelope, especially if the gills are white.

3. Avoid fungi having a milky juice, unless the milk is reddish.

4. Avoid all tube-bearing fungi in which the flesh changes color when cut or broken, where the mouths of the tubes are reddish; in the case of other tube-bearing fungi proceed with caution.

5. Fungi that have a sort of spider web or cottony ring around the upper part of the stalk should in general be avoided.

6. Mushrooms with white gills and a ring on the stem, especially when the gills become greenish at maturity, should generally be avoided.

7. Mushrooms that have brown to black gills which grow on animal dung should generally be avoided.

8. Unless you are very familiar with the edible species you are collecting, never gather mushrooms in or near wood areas except for study.

9. Do not eat any mushroom on the word of the self-styled expert, unless you are personally familiar with the species in question.

10. Boiling does not suffice to rid a deadly variety of mushroom from poison.

11. Upon arrival from a collecting trip, examine again all mushrooms in the collection basket and discard any poisonous or undesirable ones.

12. Mushrooms should always be eaten soon after gathering (though many species may be dried for future use). As in the case of all organic substances, changes brought about by bacteria and molds soon set in. A fungus in which the gills or pores are altered by parasitic attack should never be gathered for the kitchen. No one would think of eating meat that was not fresh, unless frozen, or fish or fruit from a damaged tin. Old mushrooms and those burrowed by larvæ should be rejected.

13. As in the case of some other foods, many people are unable to eat mushrooms of any description without discomfort.

14. Mushrooms that are perfectly fresh and wholesome may prove indigestible even to those whose digestive powers are in no wise defective. Faulty cooking or overindulgence in eating are frequent causes. A heavy meal of mushrooms on returning from a long walk, tired and hungry, is harmful; in no case should fungi be eaten unaccompanied by other foods, such as rice, bread, or meat.

MUSHROOMS IMPORTED INTO THE PHILIPPINES

Mushrooms imported from foreign countries constitute the only regular mushroom supply for the restaurants and homes in the Philippines. The native mushrooms are available only during the mushroom season, yet a small quantity of these reach the market. The growing popularity of Chinese dishes in chop-suey houses, and the introduction of the popular Japanese "sukiyake" in Japanese restaurants demand an increasing supply of mushrooms. The most popular imported mushrooms are *Pleurotus ostreatus* (Plate 6, fig. 1) and *Auricularia* spp. (Plate 6, fig. 2) from China, the "shiitake" (Plate 6, fig. 3) from Japan, the champignon from France, or mushrooms from the United States. The last two mentioned are *Psalliota campestris*.

The species of *Auricularia* are imported in dried form. Foo-chow, China, is the center of trade. These species are somewhat leathery. Before cooking, they should be soaked in water to restore their original form. They become tender and melow. The species of *Auricularia* are the most popular of the mushrooms in the Philippines. They are almost always combined with Chinese dishes, especially those that are stewed, like chop suey, "pinsi," and others. There are several species of *Auricularia* sold in the market, chief among which are *A. auricula-judæ* (Plate 62) and *A. polytricha* (Plate 63, fig. 2). All these species are also found in the Philippines. Unfortunately few people know them. These mushrooms are found abundantly on rotten trunks and branches of trees, especially in the forest. The native species of *Auricularia* are clean; besides, they can be collected in the fresh condition. The sources of imported auricularias and the methods used in their preparation for market are unknown to us.¹⁰ Imported auricularias are found in Ma-

¹⁰ On the Chinese method of mushroom culture, JULIAN ARNAUD, Mushroom as an article of commerce, Daily Consular Trade Reports, Washington, D. C., No. 299 (1918) 1117-1118, may be consulted.

nila markets, particularly in Chinese "tiendas," where they are sold at 4 pesos¹¹ per kilo for the first grade, and at 2 pesos per kilo for the second grade.

The shiitake mushroom, scientifically known as *Cortinellus Shiitake*, is now becoming very popular in Japanese restaurants, as well as in Chinese chop-suey houses. It can be purchased both in the large Chinese "tiendas" and in Japanese groceries. It is imported in dried form and sold according to grade, depending on the size. The first grade is sold at 4 pesos per kilo, and the second at 3 pesos per kilo.

Like other dried mushrooms, *Cortinellus Shiitake* should be soaked in water before cooking, and later rinsed well so as to remove all dirt adhering to the crevices and surfaces of the plant. After soaking, it regains its original shape and softness. This is the most delicious species among the dried mushrooms. *Pleurotus ostreatus* is imported from China in dried form and found in Chinese chop-suey houses, although it is much less used than the auricularias, for it is used in highly prized dishes. This mushroom can be purchased in Chinese "tiendas" for 4 pesos per kilo. *Pleurotus ostreatus* is also found in the Philippines, although in more limited numbers. It grows on rotten, fallen trunks of trees in humid forests. There is no doubt that, once the artificial method of growing it has been studied, this mushroom can also be grown commercially in the Philippines. *Pleurotus ostreatus* should also be soaked in water and washed well before cooking in order to restore its freshness and its normal form and size, and at the same time to remove the dirt from the gills and other parts of the plant. When it is cooked, it is as good as any other good mushroom, like *Collybia* sp. and *Volvaria esculenta*. The stem is somewhat tough, but the cap and gills are soft. Mixed in chop suey or some other stewed dish, it is delicious.

Shiitake mushrooms in Japan are fast becoming an important forest by-product. Interesting information on the food value of this mushroom and on the methods of culture by the Japanese are given by Shozaburo Minura, in Notes on "Shiitake" (*Cortinellus Shiitake*) culture. Extracts may also be referred to in the Bulletin of the Forest Experiment Station.¹²

¹¹ One peso equals 50 cents United States currency.

¹² Meguro, Tokyo, Bureau of Forestry, Department of Agriculture and Commerce, Tokyo (1915) 109-114.

"Champignon" is the French name for mushroom. *Psalliota campestris* is the mushroom imported from France and the United States. It is sold canned in the market. Hotels, restaurants, and homes use a good deal of this mushroom. It is very delicious and used in many European dishes, especially French.

Lately, the importation of canned mushrooms from the United States has increased materially along with the progress in the development of the mushroom industry in that country. The artificial growing of *Psalliota campestris* has increased rapidly in recent years. Many of the states are now engaged in highly specialized methods of culture. They use mushroom houses which are artificially heated during winter and cooled during summer. In the United States mushrooms are now produced all the year round and can be purchased at nominal prices.

METHODS OF MUSHROOM CULTURE IN THE PHILIPPINES

There are no well-developed methods of growing mushrooms in the Philippines. Those that are practiced, although alike in principle, vary in different localities according to the cultural materials most abundantly available. They are simple affairs, evidently the product of experience based on the observation of the growth of mushrooms in their natural habitats.

In the Ilocos provinces, and in Pangasinan, a rectangular plot is laid out (Plate 7, fig. 1), a low bamboo fence is built to hold the fillings inside, and to keep away animals. A pit about a foot deep is dug in the ground inside the fence. It is said that the deeper the pit, the better will be the result. The pit is filled up to the surface of the ground with chopped banana trunks. Chopped banana materials rot fast, and a good crop may be obtained early. As the material is being dumped into the pit, it is trampled down in order to make the bed as compact as possible. Sometimes rice straw is piled up to about a foot high on top of the banana filling and trampled down also. On top again of the rice straw or on the banana filling, empty mongo pods are piled up as thickly as possible. In some Ilocano districts rice husks are spread out to a good thickness on top of the banana trunks, rice straw or mongo shells or both being omitted. Closely woven bamboo strips are placed over the beds, and on top of the fence in order to keep animals away, especially chickens. These mushroom beds are made about the middle of March or at the beginning of April, long before the rainy season

begins, in order to allow ample time for the materials to rot. As the rainy days start, and the beds begin to be continuously soaked in water, they soon rot, so that about the middle of May or early in June mushrooms begin to grow. There is no limit for the growing of mushrooms in the beds, as the length of the season depends mainly on how long the rains last. When the rainy season is long, the production of mushrooms in these beds is extended to as late as October or November. When the rainy season is short, mushroom production lasts only to about the end of September.

In the Tagalog provinces, like Bulacan, Nueva Ecija, and Rizal, farmers pile their rice straw into big stacks (Plate 8) for animal feed. Because of continuous rains, the surface of these stacks of rice straw is soaked with water and soon rots. At first the stacks become ashy brown on the surface, then cottony white. This is the spawn. This stage is followed by the button stage of the mushroom itself. Mushrooms grow almost everywhere on the surface of the stack, but more readily at the crevices at the base. Unfortunately the production of mushrooms on these stacks does not last long, for the animals are continuously being fed on the rice straw until it is all consumed. On the scattered animal feed and manure mushrooms grow continuously throughout the season (Plate 9).

In regions where there is a much longer period of precipitation, as in the Bicol provinces, the mushroom season is more extended. Besides the favorable climate for mushroom growing in these places, the abaca plant, which is an excellent substratum for its culture, is found in abundance. Mushrooms still in the button stage are gathered every morning in baskets. They are of very good flavor and constitute a good and sure supply of viand in every home of the plantation.

The manner in which mushroom beds are prepared depends mainly on the materials available in a given locality. For example, in regions where sugar cane is the main crop, bagasse is most suitable. In places, where abacá is available, as in the Bicol regions, the trunks, stumps, and leaves of this fiber plant are used instead of banana. In cities like Manila, Cebu, and Davao, where banana and abacá waste is abundant, these materials can be satisfactorily used. Banana sheaths are used for wrapping large bales of tobacco leaves. These bales are commonly called "fardos." When the tobacco leaves are used in making cigars or cigarettes the banana sheaths are thrown

away. The abacá fiber waste could be obtained from the many cordage companies in the large cities. Even old rice sacks could be made into a mushroom bed (Plate 7, fig. 2).

In Vivencio's work on mushroom culture¹³ four methods based on those used in Pampanga Province are described: The rice-wash method, the common-salt method, the bagasse method, and the banana method.

The rice-wash method and the common-salt method call for piling chopped rice straw in a shady cool place, usually under bamboo trees, the bed of rice straw being about 25 cm thick above the surface of the ground after being trampled down. The rice-wash method and the common-salt method are identical, except that the liquids used for keeping the beds moist are different; in the rice-wash method, the liquid used is rice wash. This liquid is milky in appearance. For the common-salt method, the liquid used is a weak brine, a solution containing one spoonful of salt for every liter of water. In all cases the mushroom bed should be rectangular in form so that it can be easily worked.

The bagasse method consists in piling together fine pieces of sugar-cane bagasse. This bed should be watered with much sugar-cane juice, at least seven times daily for one month, and afterwards kept moist.

In the banana method, chopped banana trunks, stumps, and leaves are piled to a thickness of about 30 centimeters or more. As in other cases, it should be watered.

The use of spawn to inoculate the beds is not necessary, for the common edible mushroom, *Volvaria esculenta*, grows spontaneously.

POSSIBILITIES OF GROWING MUSHROOMS COMMERCIALY IN THE PHILIPPINES

Volvaria esculenta has great commercial possibilities in the Philippines, if mushroom culture is carried on properly. The good qualities of this mushroom and the presence of abundant materials for its culture are favorable for the development of the mushroom industry in the Philippines. In fact this mushroom is grown in many provinces in Luzon, although on a limited scale and for a brief period of the year. *Volvaria esculenta* is one of the most popular mushrooms in the market, and is sold at a high price.

¹³ Philippine Agriculturist and Forester 5 (1916) 119-128.

Another mushroom that has great commercial possibilities in the Philippines is the ordinary *Psalliota campestris*. This species is grown in the United States and in some countries of Europe. For its culture an appropriate mushroom house should be constructed, like those used in the United States. In this mushroom house the temperature should be kept at from 50° to 60°F. For this purpose a refrigerator is necessary. Another encouragement for this mushroom is the use of rice straw. It has been proven that *Psalliota campestris* can be grown artificially in the Philippines under controlled temperature, and on rotten rice straw instead of on horse manure. The problem is to secure a suitable temperature and at the same time to reduce expenses so as to make mushroom growing a profitable industry in the Philippines.

EDIBLE WILD MUSHROOMS

The first and most important thing to be remembered by the collector of wild mushrooms for the table is that he must gather only such species as he is perfectly familiar with. Any one who will accept a mushroom merely because the gills are pink or because the skin of the cap will peel off, or merely because it is growing along with a well-known species or in a place where a well-known species has previously been collected, should be discouraged from collecting mushrooms for the table, for he is certain, sooner or later, to get some poisonous specimens mixed in with the good ones. It is best to reject all specimens of doubtful edibility.

The best time to collect mushrooms is early in the morning, for at that time all those which have opened during the night are fresh and free from insect infestation. The only thing needed for collecting is a basket to carry the specimens in. It is well, however, to take along a garden trowel and a sharp knife or small "bolo," and to get into the habit of digging up the mushrooms instead of picking them, because there are some species which even the expert cannot recognize unless he has the whole of the stem. If the mushroom is picked or broken off above ground, one of the most evident marks for identification, the volva, may be left behind in the soil.

All mushrooms that are not perfectly fresh should be rejected. Many cases of so-called mild mushroom poisoning have been caused by the careless eating of specimens infested by larvæ of insects. Tainted mushrooms are as unwholesome as tainted

meat. Although many of them will keep well for a considerable time when the weather is cool, in warm weather they very soon become unfit for food.

Side by side with the known edible species, many beautiful and interesting fungi are found, which are not discussed in this publication. If one becomes interested in knowing what they are, he must obtain one or more of the larger publications or books listed on pages 116 and 117. For those that cannot be identified with the help of these publications or books, specimens may be sent to the mycologist of the Bureau of Science, Manila, for identification. These specimens should always be accompanied by a letter giving full information as to the appearance of the fresh specimens, their place and manner of growth, and other pertinent data. The specimens should be wrapped in oiled paper or grocer's butter paper, placed in a box, and mailed at once. In hot weather specimens that are apt to decay quickly should be first wrapped in a cloth that has been moistened with 6 per cent formalin, and then in butter paper. Another way, which in some cases will serve even better, is to photograph the fresh specimen, dry it, and send both the dried specimen and a copy of the photograph with the letter.

The following mushrooms are suggested for collection by a beginner. Puffballs (Plate 70), are said to be all edible, white, tender, and homogeneous inside. Puffballs grow on the ground. Oyster mushrooms, such as the *Pleurotus* species (Plates 29 to 31) and their nearest relatives, are recommended; they are large, having white gills and a short stem. The stem is generally eccentric. *Collybia* (Plate 23) and *Lentinus* species (Plates 37 and 40) are all edible, and although *Lentinus* species are a little tough, they make delicious soup. The ordinary field mushrooms, *Psalliota* species (Plates 47 to 50) are highly recommended. They can easily be detected because of their brown gills and their shaggy ring, the remnant of the veil. All species of *Auricularia* (Plate 61, figs. 2 and 3; Plate 62), taiñgang-daga in Tagalog, the smooth and the hairy species, are edible. Cooked, they are deliciously mellow, especially if stewed in chop suey. The *cuDET* (Ilk.), *Schizophyllum commune* (Plate 33, fig. 2), is not to be scorned. Dried taiñgang-daga and the *cuDET* should be well soaked in water before cooking in order to restore their normal form and softness.

THE PREPARATION OF MUSHROOMS FOR THE TABLE

All mushrooms should be thoroughly washed, but they should be washed quickly and in cold water only, since warm water or prolonged soaking in water injures the flavor of many species. Some species are improved by soaking for some time in salt water. All specimens that are not perfectly fresh or that are in the least infested with insects should be discarded. A few kinds should be peeled, but as a rule peeling removes some of the best-flavored parts. The stem of most species should be removed, although if the stems are very tender there is no reason why they should not be used. Mushrooms should not be kept long in a fresh condition. If they cannot be used at once, they should be perfectly cooked and placed in the ice box until needed.

As a rule mushrooms may be cooked along with meat and poultry, or used as flavoring for soups and sauces, or for stuffing peppers or tomatoes. The better-flavored species should be cooked simply and seasoned lightly, while those of poorer quality may be improved by more elaborate cooking and thorough seasoning. A few species that are slightly bitter in the raw state should be boiled more. The majority of mushrooms, perhaps, are best simply broiled or stewed with vegetables, meats, or shrimps as ordinary "gulay." In "gulay" prepared with mushrooms, ginger is almost indispensable as an ingredient.

The Filipino recipes given below were collected from several housewives in different parts of the Philippines. Some of these recipes were tried in the laboratory and found to be very successful.

MUSHROOMS WITH AMPALAYA

One part ampalaya	Fried fish (bañgos or dalag)
One part mushroom	Bagoong ¹⁴ to taste

Cut the ampalaya into pieces 6 to 7 cm by about 4 cm. Place in a container with sufficient water to cover and add the bagoong. Bring to a boil, add the ampalaya, and cook for three minutes. Then add the mushrooms, and lastly the fried fish. (Left-over fried fish may be used.) Continue boiling until done. Do not stir the mixture.

FRIED MUSHROOMS

Beat the yolk of an egg with a tablespoonful of water, and season with pepper and salt. Dip each cap into this mixture, and then into fine

¹⁴ Salted, fermented anchovies.

cracker crumbs or corn meal. Have butter or shortening very hot in the frying pan. Fry slowly on each side five minutes. A sauce can be made by thickening the butter or shortening with flour.

MUSHROOMS WITH CHICKEN

1 Small chicken	2 Segments garlic
24 Mushrooms	2 Tomatoes
1 Onion, sliced	Salt to taste

Dress the chicken, cut into pieces suitable for serving, wash, and boil with enough water until almost done. Fry the garlic, the onions, tomatoes, and the chicken meat with all bones removed, and lastly the mushrooms. Add the chicken broth to the mixture and continue boiling until done. Season with salt and pepper. Serve hot.

MUSHROOMS WITH YOUNG CORN

24 Large mushrooms	½ Lb pork, sliced fine
1 Cup young corn scraped from the cob	3 Chopped tomatoes
1 Onion, sliced	Tender leaves of sili
	Salt to taste

Fry the onions, the pork, the tomatoes, the corn, and the mushrooms. Add two cups of meat stock and boil slowly until cooked. Season with salt, and lastly add the sili leaves.

MUSHROOMS WITH SHRIMPS

24 Large mushrooms, more if they are small	3 Medium-sized guavas, sliced
1 Cup sliced shrimps with skins removed	2 Big tomatoes
1 Cup chopped pork	1 Onion, sliced
	2 Segments garlic, minced
	Salt to taste

Fry the garlic, the onion, the shrimps, the pork, the tomatoes, the sliced guavas, and lastly the mushrooms. Add about 1 cup of shrimp broth and allow to boil. Season with salt and pepper. Serve hot.

MUSHROOM TAMALE

Add enough salt to the mushrooms that have been previously sorted, cut into pieces of desired size, and washed, and wrap in banana leaves. Cook over live coals and when done on one side, cook the other side. Serve with calamansi juice.

MUSHROOM OMELET

6 Large mushrooms	1 Onion, sliced
2 Eggs	Salt to taste
1 Tomato	

Wash the mushrooms, cut into small pieces, and squeeze them to remove as much as possible of their water content. Fry the onion, the tomato, and the mushrooms. Season with salt. Beat the eggs and pour over the mushroom mixture, stirring with the fork until thoroughly mixed. Fry both sides on a well-greased pan. Serve hot.

STEWED KABUTENG PUNSO (*Collybia albuminosa*)

12 Large mushrooms	2 Tablespoonfuls of calamansi
A small piece of ginger	juice
	Salt to taste

Remove the cuticle from caps of mushrooms and cut caps into pieces of desired size. Cut the stem to a length of about one inch. Cover with about one-half cup of water and allow the mixture to boil. Add the ginger and season with salt. When tender, add the calamansi juice to remove the slimy characteristics of this mushroom. Serve hot.

Other mushrooms may be used instead of *Collybia albuminosa*. The cuticle may or may not be removed, according to the species of mushroom used.

MUSHROOM SOUP

12 Mushrooms, cut into small pieces	$\frac{1}{2}$ Cup sliced apulid
$\frac{1}{2}$ Cup boiled and flaked crabs	1 Onion, sliced fine
$\frac{1}{2}$ Cup shrimps, sliced	Young leaves of onions, cut into small pieces
1 Cup cabbage, previously blanched and cut into small pieces	Patis enough to taste
1 Cup sliced patola	2 Segments garlic
$\frac{1}{4}$ Cup sliced chinese ham	Salt to taste
	Vet-Sin

Fry the garlic, the onions, the apulid, the cabbage, the mushrooms, the ham, the shrimps, and the crabs. Add enough ham stock, and allow to boil. Then add the patola, the sliced onions, the onion leaves, and Vet-Sin and patis. Serve with toyo and calamansi juice.

MUSHROOM DINENDENG (Ilocano)

10 Mushrooms (<i>Colybia albuminosa</i> or <i>Volvaria esculenta</i>)	2 Tomatoes
2 Ampalaya	3 Small pieces of fried or roasted fish
6 Eggplants	A small piece of ginger
	Bagoong to taste

Cut the mushrooms into long, thin pieces; cut the ampalaya and the eggplants into pieces 6 to 8 cm by 1 cm. Cut the tomatoes into halves and the ginger into thin slices. Place the ampalaya, the eggplants, and the ginger in a native cooking pot with enough water to cover. When it boils, add the mushrooms and the tomatoes, later the bagoong and the fried or roasted fish. Before the bagoong is added, it should be strained.

MUSHROOMS WITH COCONUT MILK

$\frac{1}{2}$ Cup shrimps, peeled	1 Onion, sliced
$\frac{1}{2}$ Cup pork, cut into pieces	2 Lbs lard
2 Cups mushrooms, cut into pieces	Salt to taste

Heat the frying pan and put in the lard; when the lard is hot, put in the onion, the pork, the shrimps, and the mushrooms in the order given. When half cooked, add enough coconut milk to cover. Stir while adding the coconut milk. When cooked, spread powdered black pepper on the surface. Serve hot.

CHOP SUEY

- | | |
|---|---|
| 1½ Caps mushrooms, or tai-
n̄gang-daga or both (soak
taiṅgang-daga in water
until it looks as if it were
fresh) | ½ Cup sliced pork |
| 1 Cup boiled sliced shrimps | 2 Cups sliced patola |
| ½ Cup flaked boiled chicken | 4 Cups cabbage, cut into pieces
1 inch long and ½ inch
wide |
| 4 Tablespoons sliced Chinese
ham | 5 Tablespoons toyo |
| 3 Chinese sausages | 1 Tablespoon flour |
| 1 Cup boiled and sliced pork
liver or chicken livers
and gizzards | 4 Sliced onions |
| | 3 Tablespoons chopped garlic |
| | 2 Cups chicken broth |
| | ½ Teaspoon pepper |
| | Salt to taste |

Fry onions, garlic, shrimps, pork, ham, sausages, chicken, livers, gizzards, and mushrooms together. Add the toyo, pepper, and a small amount of chicken broth. Continue boiling for a while; then add the cabbage, later the patola, and lastly the rest of the chicken broth mixed with flour. Add enough salt to taste. Continue boiling until the vegetables are tender. Put in a big bowl and serve hot.

MUSHROOMS WITH TINAPA¹⁵

- | | |
|---------------------------------|--|
| 24 Large mushrooms | 2 Segments garlic |
| 6 Tinapa | Juice of 3 medium-sized ca-
lamansi |
| 1 Small onion, sliced | Salt to taste |
| A small piece of ginger, sliced | |

Sort and wash the caps and stems and cut into pieces of desired size. Drain well. Remove the head, the scales, and the spines of the tinapa. Fry the garlic, the onion, the ginger, the tinapa, and the mushrooms. Add a little water if necessary. If the mushrooms are rather watery there will be enough broth without the addition of water. Season with salt and pepper and lastly add the calamansi juice immediately before removing from the fire. Serve hot.

MUSHROOMS WITH STRING BEANS (PA-AYAP)

- | | |
|--|-------------------------------------|
| 12 Mushrooms | 1 Bundle string beans ¹⁶ |
| 1 Cup pork, cut into small
pieces | A small piece of ginger |
| ½ Cup shrimps, sliced, with
skins removed | 2 Segments garlic |
| 1 Onion | 2 Large tomatoes |
| | Salt to taste |

¹⁵ Smoked fish.¹⁶ A bundle is about 10 cm in diameter.

Clean and cut the mushrooms into pieces of desired size. Cut the tender string beans to lengths of about 1 inch. In the case of the mature ones, use only the seeds and discard the pods. Boil the string beans in 2 cups of rice water until tender. Fry the garlic, the onion, the ginger, the pork, the shrimps, the tomatoes, and the mushrooms, and add the string beans. Add to the mixture 1 cup of shrimp broth and the rice water in which the string beans have been boiled. Season with salt and pepper to taste.

PEPPERS STUFFED WITH MUSHROOMS

6 Large, partly ripe, peppers	1 Onion, chopped fine
12 Mushrooms	1 Large tomato
1 Cup chopped pork	Salt to taste

Cut the stem end of the peppers and carefully remove all seeds. If the peppers are quite brittle and likely to break easily, blanch them before removing the seeds, chop fine the previously sorted and washed mushrooms. Fry the onions, the pork, the tomatoes, and the chopped mushrooms. Season with salt and pepper. Fill the peppers with the mixture and lay them on a baking pan. Bake until done.

MUSHROOMS BAKED WITH TOMATOES

In a baking dish, arrange small round slices of buttered toast; upon each piece place a rather thin slice of peeled tomato, salted and peppered; upon each slice of tomato place a fine, thick mushroom, gill side up; in the center of each mushroom put plenty of butter, season with salt and pepper. Cover the dish and bake in a hot oven ten minutes; then uncover and bake for an additional five or ten minutes, as the mushrooms seem to require.

TOMATOES STUFFED WITH MUSHROOMS

Wash smooth, solid tomatoes (preferably an American variety); cut a slice from the stem end and remove carefully the seeds and core. To each tomato allow three large mushrooms; wash the mushrooms, dry, chop fine, and stuff into the tomatoes; put a half saltspoon of salt on the top of each and a dusting of pepper. Into a bowl put one cup of soft bread crumbs, season them with a half teaspoonful of salt and a dash of pepper, pour over them a tablespoonful of melted butter, and heap them on top of the tomato, forming a sort of pyramid, packing in the mushrooms; set the tomatoes in a baking pan and bake in a moderate oven 1 hour. Serve at once, lifting them carefully to prevent breaking.

OYSTERS AND MUSHROOMS

Wash $\frac{1}{2}$ pound of fresh mushrooms and remove the stems; chop them fine; put them into a saucepan with a tablespoon butter, a half teaspoon salt, and a dash of pepper; cover closely, and cook over a slow fire for ten minutes. Have ready, washed, and drained, twenty-five large fat oysters; throw them perfectly dry into this mushroom mixture. Put the saucepan over a bright fire; boil, stirring carefully, for about five minutes. Serve on squares of carefully toasted bread.

METHODS OF PRESERVING MUSHROOMS

During the mushroom season there is always an abundance of mushrooms, and often a considerable surplus is left unused. In order to utilize this surplus, people should know some methods of preserving mushrooms. One method is drying and using them in the whole or powdered. Many of our mushrooms can be dried. The other method is either bottling or canning. Mushrooms can also be made into catsup.

After the mushrooms are gathered, they should be sorted at once, and those that are more or less torn separated from those that are still intact; those that are in the button stage should be set apart. The buttons of various sizes may be canned. At this stage they are firm and retain their color after heating. Old mushrooms that are canned lose very much in bulk, become mushy, and often turn black. The old ones and those which have broken caps and detached stems should be made into catsup. Those with fully opened and still firm caps may be dried or made into powder. Mushroom powder keeps very well and is one of the most delicious flavoring condiments of the kitchen.

In drying, the mushrooms should be first thoroughly cleaned in water to remove all dirt adhering between the gills or in the pores and on the surface. They should be placed singly on boards or racks and dried in the sun or air. They should be turned over every day, and not be left out during the night as they absorb moisture very rapidly. They may also be dried on wooden trays in a warm room, during the days when there are no rains. In making powder, those that are already dried and brittle can be powdered in a small mortar with a pestle. The powder should at once be placed in well-stoppered dry bottles or fruit jars, sealed, and kept in a cool, dry place. A very excellent method to make the dried mushrooms more delicious and to improve their keeping quality is the "toyo" method. It consists of soaking the mushroom in "toyo" for about one minute, after washing them thoroughly. Then they are dried as described above. In the Philippines "toyo" can be purchased in any "tienda" at very small cost.

Mushrooms may be canned as easily as fruit and much more readily than some vegetables. Those that are still closed are cleaned by peeling or by wiping with a cloth, removing dry dirt or earth which may have adhered to them. The stems are cut off, allowing a length of $\frac{1}{2}$ to 1 inch to remain attached to the cap. Then they are placed in an iron kettle and heated

without water until shrinking ceases, after which they are placed in cans that have previously been cleaned and scalded, and enough of the liquor poured over them to fill the can completely.

Fruit jars or mason jars may be used. After filling, they are placed in any kind of cooking vessel provided with a cover and containing a small amount of hot water. A sheet of asbestos, or a thin layer of excelsior is placed in the boiler to prevent the glass from coming in contact with the bottom. The caps are placed loosely on cans, and with steamer cover in place the water is allowed to simmer for half an hour. Upon removing the cover from the steamer the jar covers are immediately screwed down, in order to show leaks. If all are perfectly sealed, they are allowed to stand for 24 hours, when they are again heated in the same manner, except that the time of steaming must be prolonged to one hour, because the contents of the cans are cold. A repetition of this operation on the third day will complete the sterilization, and on opening the cans the mushrooms will be found to be as nearly like the fresh article as it is possible to have them. They keep well and do not deteriorate in consistency nor flavor. The cans must be kept sealed throughout the operation.

If desired, the mushrooms may be stewed in milk, or prepared in any manner for the table and then canned in the manner described. When the can or jar is opened, they require heating only before serving. When cans are used they are handled in the same manner as the glass jars, with the exception of soldering the lid as soon as the can is filled, leaving the vent open until after heating the first time, when it is immediately closed with a drop of solder while the can is hot, to form a partial vacuum that takes up the expansion caused by subsequent heating.

This method of sterilizing kills the vegetable germ cell at the first heating, and the intervals between heatings induce the spores to germinate into cells, so that a much lower temperature is needed than would be required to kill the spores.

If it is desirable to sterilize the mushrooms at one operation, the cans should be filled as already described, and after sealing, heated to a temperature of 240° F. for 30 minutes. This process, however, requires a steam chest capable of withstanding a pressure of over fifteen pounds to the square inch, which is not commonly found in the home; besides, the flavor

and the texture of the article canned are materially impaired by this high temperature, and glass jars cannot be used.

FOOD VALUE OF MUSHROOMS

The food value of mushrooms lies chiefly in their flavor. Measured by the amount of energy that can be obtained from them, they do not rank very high. On that basis the ordinary mushrooms are found to have a food value about the same as that of cabbage, less than one-half that of potatoes, or about one-twentieth that of wheat flour; but nevertheless people enjoy them because of their flavor, and most of us can enjoy mushrooms as soon as we learn a few species so that we can eat them without fear of poisoning. The market price of mushrooms is beyond the reach of the common people, but there are tons of excellent wild species that are allowed to decay in the woods and fields every year. These will furnish variety and flavor to the diet of thousands of families, at the cost only of the time to collect them, as soon as people have learned to distinguish them from one another.

BENEFITS DERIVED FROM MUSHROOMS OTHER THAN FOOD VALUE

Mushrooms are of value not only as an article of food, but also as a source of various profitable enjoyments. The pleasure of the search, the thrill of the discovery, and the opportunity they afford for healthful outdoor recreation are no less important. Of course, these benefits cannot be obtained by the purchase of any amount of mushrooms from the market. Mushroom collecting is as exciting as game hunting. Moreover, mushroom hunting cultivates the power of observation toward nature, and provides a good chance for a man to forget his worries in life, to better and brighten his outlook, and last but not least, it provides a good means for prolonging dear life itself.

There is now a live interest in mushroom growing the world over. In many communities in the United States, clubs of mushroom growers have been formed and are very active. In some public schools of the Philippines, for example in Bataan Province, mushroom culture is included as a project in the school curriculum, together with poultry raising, hog raising, gardening, and others.

Another indication of the importance of mushroom growing is the increasing interest of people in them as objects for nature study. Their habit of growing in the ground, in the woods, and in living trees for weeks, months, years, and even centuries;

their development from an ordinary buttonlike structure to a large round shape, a hog's head or the umbrella-shaped, certainly offer a field for nature observation. Mushrooms help man in many ways; they cause dead vegetable matter to decay and thus fertilize the soil. Even the deadly poisonous *Amanita muscaria* (Plate 12) has some use. The extract of this mushroom is used to poison flies in some countries. Some of the hard fungi, like *Polyporus squamosus* and *P. betulinus*, were at one time used in the manufacture of razor strops. The fiber parts of several of the hard fungi were used as tinder. In powder form they were used as snuff. In some countries interesting objects, like bedroom slippers and smoking caps, were made from the pliant sheets of some of the hard fungi. Others, because of their shape, are used as flower pots. People are very fond of etching figures on some of the hard species that are easy to work on. When they are perfectly dry, they may be used for fuel.

A number of the fungi were formerly employed in medicine for various purposes. Some of them are still being used in some countries. Some of them were used as a purgative, as in the case of certain species of *Polyporus*. In England the species of *Auricularia* were formerly used as a remedy for dropsy and for sore throat. Other species of *Polyporus* are employed in Burma as a medicine to expel worms from the bodies of animals. Puffballs, when mature, are in great demand in rural districts in the Philippines for stopping bleeding.

COLLECTION AND PRESERVATION OF MUSHROOMS FOR STUDY

In the collection of mushrooms for study, it is essential that all parts be kept intact. A single character missing may make it impossible to place the specimen in the right genus, not to mention the difficulty of identifying it as to species. Notes on the important evanescent characters should be taken while the specimen is still in the fresh condition. Then the specimen may be dried or preserved for future study.

The following list of apparatus is recommended:

1. A rectangular hand basket with a capacity of 10 to 14 quarts.
2. A good quantity of soft newspaper.
3. A good, sharp knife, a small-sized "bolo," memorandum pad, and pencil.

During the rainy season mushrooms are found in great abundance in woods, thickets, open fields, and especially in forests. They are not so numerous during the dry season, although even then many can be collected in the damp forests, especially at

high altitudes. In collecting specimens, care should be taken that the roots be not destroyed or left in the soil. Hence, in collecting specimens growing on the ground, like *Collybia*, *Lepiota*, and many others that are deeply rooted, a sharp, small-sized "bolo" is very handy. There are also many that grow on rotten wood, and in ordinary picking the roots and a portion of the stem may remain in the wood. A sharp knife or a small-sized "bolo" should be used to chop off the part of the wood where the substratum is rooted. The specimens should be wrapped in soft newspaper at once, as many of these fungi are characteristically covered with fine powder which will stick to the fingers unless precautions are taken against its rubbing off.

Only notes on the habitat and the environment, which are very important, should be taken down at once in the spot where a specimen is collected. These details may cover the place of collection—groves, woods, open fields, grounds, sticks, stumps, trunks, living trees, or rotting wood, and the kind and character of the soil. Other notes necessary to make the study complete should be made at once upon arrival in the laboratory, as mushrooms are perishable and many of the important characters quickly disappear.

Upon arrival from the field, the specimens should be sorted at once in order to avoid confusion later on. The species belonging to the genus *Coprinus* (Plate 52) deliquesce very fast, and *Galera* (Plate 44, fig. 2) and *Psathyrella* (Plate 53, fig. 3) collapse very rapidly.

The color of the spores cannot be well determined, even when they are examined under the microscope, unless a sufficient amount is collected on a piece of paper. This mass of spores is called 'spore print' (Plate 10). The spore print may be prepared by placing the cap on a piece of paper, removing the stem from the cap (the gills facing downward), and covering it with an inverted bell jar or tumbler. The spores fall on the paper in large quantities within an hour or so. To bring out the color of the spores, the color of the paper should be in contrast with it. For example, if the spores are white the paper should be black; or, if the spores are black, the paper should be white.

When the necessary notes have been taken, the mushrooms are ready to be preserved, in either liquid or dried form. While the weather is fair, specimens can be put into the sunshine to

dry. During the rainy season they better be left in the room with the windows wide open, as it is dangerous to bring them out where they may get soaked in the rain and rot. A method to dry the specimens inside is by means of artificial heat from the stove. A crate of about a meter square is hung over the stove on the four corners. The distance between the crate and the stove depends upon the amount of heat given out by the stove. The opened packets containing the specimens are placed on the crate. Later the dried specimens are dipped for about 5 minutes into a poison solution which is prepared according to the following formula: 1 liter of denatured alcohol, 40 grams of mercuric chloride, 10 cc of phenol. The specimens are dried in the air, then packeted and kept for future study. It is necessary to poison the specimens so that insects cannot destroy them.

For preservation of fresh specimens in liquid, three solutions were found successful. These are: the sulphurous acid preservative, ordinary 75 per cent denatured alcohol, and formalin-water-alcohol. In the first method, the specimen is put in a 20 per cent solution of blue stone (copper sulphate) for 24 hours or less, depending on the texture of the specimen. If the specimen is soft, it should be put in less than 24 hours. Even if it is hard, it should not remain in the solution longer than 24 hours. After the specimen has been removed from the solution, the precipitated copper is carefully washed off, and the specimen transferred into a permanent bottle or container with clear or distilled water. Sulphur dioxide gas is then evolved from a small tank into the water that contains the specimen up to the point of saturation. The resulting solution is sulphurous acid. The preserving solution, 75 per cent denatured alcohol, is handy and cheap. The formalin-alcohol-water preservative is prepared in the following proportions: 1 liter of water, 226 cc of formalin, 140 cc of denatured alcohol. The solution is filtered through cotton.

The choice of the preserving solution depends upon the nature of the specimens; if the specimen is hard and the color disappears easily the use of the sulphurous acid preservative is satisfactory. If the specimen is soft and small, 75 per cent denatured alcohol would do very well. Formalin-alcohol-water was found satisfactory in all cases. The objection to the formalin-alcohol-water is that formalin is not very comfortable to handle as it peels the skin off.

Whenever possible, specimens should be preserved in liquid. This method has the advantage over the drying method, as it preserves the shape and often the natural color of the specimen.

LIST OF AUTHORS

The binomial botanical name of each plant is followed by the name, either abbreviated or in full, of the person or persons who named the species. The following is a list of authors of the species described in this paper, arranged by countries:

AUSTRIA.

Bresadola, Abbe J.

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Gillet, C. C.

Hariot, P.

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Montague, Camille.

Patouillard, N.

Quelet, L.

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Schaeffer, J. C. von.

Schroeter, Julius von.

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CLASSIFICATION OF MUSHROOMS

The true fungi are usually divided into three classes; namely, the Phycomycetes, which include the common molds, the Ascomycetes or sac fungi, and the Basidiomycetes. With the first group we are not concerned, since its members are not large

enough to be considered mushrooms or toadstools. In the Ascomycetes are included many fungi of high economic importance, causing many plant diseases. These also are too small to be called mushrooms, except a few, the most important of which are the morrel (Plate 74, fig. 1), the cup fungus (Plate 75), and *Xylaria* (Plate 77). The third group are the Basidiomycetes to which the majority of the mushrooms and toadstools belong. With this group we are primarily concerned. Its members are called Basidiomycetes because they have the club-shaped fruiting bodies called "basidia" (sing. "basidium," meaning a little pedestal).

The scientific name of a mushroom consists of two words. The first is the generic name or group name, the second is the specific or individual name. These names are usually of Latin or Greek origin, and when they are derived from other languages they are used with Latin inflection. For example, in *Coprinus comatus*, the scientific name of a mushroom, the generic name *Coprinus* is derived from the Greek *kopros*, meaning dung, and the specific name *comatus* is a Latin word for "hairy." All mushrooms of a given kind belong to one species. All species that seem closely related are grouped together in one genus.



FIG. 3. Portion of the structure of agarics, showing the arrangement of gills. a, Gills free; b, gills adnate; c, gills sinuate; d, gills decurrent.

The color of spores plays an important part in distinguishing the various genera and species of mushrooms. The spores are classified according to color, such as white, pink, yellow, purple-brown, or black. In addition to the color of the spores it is

necessary to determine the presence or absence of the volva or the ring, or both. It is also essential to note where the gills are attached. This may be determined clearly by making a longitudinal cross section through the middle of the cap and stem. The gills are free (text fig. 3*a*) when they do not touch the stem; adnate (text fig. 3*b*) when they are slightly attached; sinuate (text fig. 3*c*) when they show a slight curve or sinuation near the stem, and decurrent (text fig. 3*d*) when they run or descend down the stem.

In order to show the exact tint of the spores produced by a certain species, the print of the spores in mass should be secured. The method used is fully described on page 36.

The shape of the cap is also essential in the identification of mushrooms. The *pileus* or cap is either convex (text fig. 4*a*), campanulate or bell-shaped (text fig. 4*b*), or conical (text fig. 4*c*).

For the generic determination it is essential to know whether the consistency of the fungus is leathery or fleshy. In the determination of species it is important to go to the specific description and to become familiar with every detail.



FIG. 4. Portion of the structure of agarics, showing the different formations of the caps. *a*, Convex; *b*, campanulate, or bell-shaped; *c*, conical.

Class BASIDIOMYCETES

The great majority of the fleshy fungi belong to the class Basidiomycetes. These are characterized by the development of the sporophore, or fruit body, called "mushroom," "toadstool,"

“punk,” and other names. They are frequently large and different in form, size, and color. In certain areas the fruit body is differentiated into a spore-bearing surface. Sectioned and examined under a microscope, this fruiting surface (text fig. 2) is found to consist of a close layer from which the basidia arise, ordinarily in a palisade. Each basidium produces as a rule four spores. Every one of the spores is borne on a sterigma.

Order HYMENOMYCETES

The layer composing the spore-bearing organs is naked. The basidia and spores are exposed in mature plants.

AGARICACEÆ

The members of the family Agaricaceæ are characterized by their gills, usually bladelike structures on the under side of the cap. The surface layer of these gills constitutes the spore-bearing surface, called the “hymenium.” The gills radiate from a stem, which usually is central, but sometimes eccentric or lateral. The umbrella-shaped kind is the most important and most common in this family. The Agaricaceæ constitute the majority of the conspicuous fleshy fungi. The spores of the family Agaricaceæ may be black, purple-brown, yellow, pink, or white.

The key to the genera of the family Agaricaceæ is divided into five columns based on the color of the spores; namely, white, yellow, pink, purple-brown, and black. In order to determine the genus to which a specimen belongs, we must be certain that the mushroom in question belongs to the family Agaricaceæ. This is determined by the presence of gills.

Upon collecting the spores of a mushroom on a piece of paper, we see that the spore print is white. The plant is fleshy and more or less firm, and when laid aside for a while it rots easily. The stem is central and the substance of the stem is distinct from the cap. Upon further examination we find that the stem has a ring, and a cup at the base. These findings lead us to the conclusion that the mushroom in question belongs to the genus *Amanita*.

The same key may be used to identify a brilliant red mushroom. Upon collecting the spores on a piece of black paper, we find the print white. The tissue is fleshy, more or less firm, and rots easily at maturity. The stem is at the center of the cap, the substance combining with and similar to that of the cap. The ring is absent and the gills are rigid and brittle. The volva is

Key to the genera of Agaricaceæ.

	Spore prints.				
	White.	Pink.	Yellow.	Purple-brown.	Black.
1. FLESHY, NOT LEATHERY NOR WOODY.					
A. Ring, volva, or both, present:					
1. Ring and volva present.....	<i>Amanita</i>				
2. Only volva present.....	<i>Amanitopsis</i>	<i>Volcaria</i>			
3. Only ring present, 4.					
4. Gills free.....	<i>Leptota</i>			<i>Psalliota</i>	
Gills adnate or slightly prolonged down the stem.....	<i>Armillaria</i>		<i>Pholiota</i>	<i>Stropharia</i>	
B. Ring and volva absent:					
5. Gills exuding a milky juice when broken.....	<i>Lactarius</i>				
6. Stem eccentric or absent.....	<i>Pleurotus</i>				
7. Stem cartilaginous, 8.	<i>Collybia</i>		<i>Naucoria</i>		<i>Parasolus</i> or <i>Copelandia</i>
8. Gills adnate or free.....	<i>Omphalia</i>		<i>Galera</i>		<i>Psathyrella</i>
Gills decurrent.....					
Gills sinuate.....					
9. Stem fleshy, 10.					
10. Gills free.....	<i>Tricholoma</i>	<i>Pluteus</i>	<i>Pluteus</i>		
Gills sinuate.....	<i>Cantharellus</i>				
Gills anastomosing.....	<i>Clitocybe</i>				
Gills decurrent, thin.....	<i>Russula</i>				
Gills adnate, plant rigid, brittle, and usually brightly colored.					

C. With threadlike or spiderweblike veil:				
11. Veil forming a spiderweblike disappearing ring on the stem.				
II. MEMBRANACEOUS, OR FLESHY MEMBRANACEOUS, FRAGILE, RAPIDLY DISSOLVING OR SHRIVELLING UP.				
12. Gills easily dissolve from below upward				<i>Coprinus.</i>
III. TOUGH, LEATHERY, OR WOODY.				
13. Stem central, 14.				
14. Gills simple; dried plant reviving when moistened.				<i>Marasmius</i>
15. Stem lateral or absent, 16.				<i>Lentinus</i>
16. Gills simple, edge toothed				<i>Panus</i>
Gills simple, entire				<i>Schizophyllum</i>
Gills simple, edge split				

absent. The characteristics of specimen as mentioned above lead us to recognize the genus *Russula*.

THE WHITE-SPORED AGARICS

A good many of our well-flavored mushrooms are white-spored. *Collybia*, such as *Collybia albuminosa* Petch, called *kabuteng punso* in Tagalog (Plate 23); *Collybia* sp., commonly called *mamarang* by the Tagalogs and *mannagado* by the Ilocanos (Plate 24); the *Pleurotus* species, *anandap* (Ilocano) or *alitaptap* (Tag.), like *Pleurotus ostreatus* (Plate 30, fig. 3); many of *Lentinus*, the *kulatkulat* (Plates 38 to 40), are only a few examples of the many species of well-flavored white-spored mushrooms. We cannot deny, however, the fact that within the same group are also found deadly poisonous mushrooms, many of which are species of *Amanita* (Plates 11 and 12; Plate 13, fig. 1).

Genus AMANITA Fries

Amanos, a Greek word, is the name of a mountain in Asia Minor where edible mushrooms are said to abound. *Amanita*, the name given by Gallen, a Roman physician, to the common edible mushroom, *Agaricus campestris*, is derived from this word.

The genus is characterized by the usual warted cap and white gills which are free or are just touching the stem. The spores are white. The stem is swollen at the base and provided with a ring at the center and a volva at the base. The members of this genus are soft, fleshy, terrestrial. Most of the species are poisonous. They are usually of rather large size and grow in noncoherent groups.

The pileus or cap is soft, and in the early stage is enveloped together with the stem by a veil. In the process of development the stem is separated from the cap or pileus, leaving the veil behind attached on the cap. This veil breaks off into many fine particles resembling warts. In its youth the species vary widely in shape, built usually spherical or egg-shaped, and sometimes bell-shaped or conical. Usually the scales are covered by a powdery colored cuticle which easily sticks to the fingers when it is touched. The species have various colors, from pure white to pale brown, yellow-orange, or bright red.

The gills are white or nearly so. In some of the species the gills are stained yellow. They are free from the stem, leaving a ringlike space around. In some cases the gills are very close to the stem. They are swollen in the middle, often broader toward the edge, sometimes uniform in width, except near the stem,

ending almost abruptly toward the edge. The short gills alternate with the long ones.

The stem is generally soft, hollow and pithy. The texture of the stem is not identical with that of the cap, and is separated easily from the latter at the apex. It is cylindrical or tapering upward, generally enlarging at the base into a bulb, and seldom cylindrical throughout. The manner in which the volva attaches itself on the base varies with the species. The first group includes species having the volva resulting from the remains of the universal veil. This remnant of the veil is the true cup or sheath at the base. In the second group are the species having the volva formed only by the lower half of the universal veil and adhering closely around the bulb, or sometimes forming only circular rolls or scaly ring on the lower part of the stem. The third group includes those that have a very fragmentary cup, more or less cottony in appearance, easily crumbled, or warty. This volva is formed by the loose and frail texture of the universal veil. While the stem is pulled from the soil during the process of growth, the remnants of this universal veil disappear easily from the stem. Because the volva does not show itself as a very distinct permanent character among this group of *Amanita*, it is advisable to rely on characters other than the death cup in order to insure the right identification. The annulus is more or less permanent on the stem, sometimes located on the lower portion, as an inferior annulus, or on the upper part, as a superior annulus.

Amanita is often called the poisonous genus, since many of the species are known to be deadly poisonous. It is true that many poisonous species occur in many other genera, yet their poison is not as deadly as that of the species of *Amanita*. No doubt, there are some edible species of *Amanita* in the Philippines, but because many of them are dangerous, it is better to let them alone, except for scientific study.

The writer on his many collecting trips on mushrooms has not noted any *Amanita*, except in December, 1933, when a species of this genus was collected on Mount Maquiling near the School of Forestry, Los Baños. However, an unreported species was found in Manila on a cool rainy day in January. Dr. W. H. Brown, who made many collections of mushrooms in the region around Baguio, Mountain Province, has brought down, during May and June, a considerable quantity of fresh mushroom specimens. From these collections, two deadly species, *Amanita mus-*

caria and *A. pantherina*, were identified. We see, therefore, that *Amanita* grows in the Philippines, and that it grows at high altitudes where the climate is cool and other conditions are favorable for growth.

AMANITA MANILENSIS Mendoza and Lens-Palo. Poisonous. Plate 11.

The cup is about 3.5 centimeters broad, covered with sharp pointed warts which are denser and larger at the center, becoming sparse and finer outwards, oblong, convex when young, becoming broadly convex when expanded, gray at the center, becoming paler towards the margin, fleshy, thicker at the center. The margin at first is entire, later cracking with age. The gills are free, white, moderately numerous, broad near the margin, gradually narrowing toward the stem, long gills intermixed with short ones. The stem is stout, white, stuffed, well formed, tapering gradually toward the pileus from a round, somewhat bulbous base, about 5 millimeters in diameter on the upper end and about 9 millimeters at the base, 3.9 centimeters long. The ring is very prominent, persistent, white, located midway on the stem, showing the remainder of a veil. The volva is thin, pale brown, adnate, irregular at the margin, covering entirely the base of the stem.

Mostly deadly poisonous mushrooms, such as *A. phalloides*, *A. muscaria*, and many other species, belong to the genus *Amanita*.

AMANITA MUSCARIA Persoon. Deadly poisonous. Plate 12.

The cap varies in color from bright yellow to orange or orange-red; it is 10 to 18 centimeters in diameter, covered with colored powdery scales that are easily washed off; at first it is nearly half-round and later flat. When young and moist, it is quite sticky. The gills are white and free from the stem. The stem is 10 to 19 centimeters long, white, or tinged with yellow, often scaly, enlarged at the lower end into a ball. The ring is white and prominent, but soon tears off. The volva is usually much torn and surrounds the swollen end of the stem in the form of scales or rings.

This species is one of the most deadly of the genus *Amanita*. The suffering of the victim is sometimes very intense. As the poison is already assimilated in the blood by the time it is felt, it has, in some cases, been difficult to save the life of the victim.

This mushroom grows on the ground in woods at very high altitudes, like Baguio, Mountain Province.

AMANITA PHALLOIDES Fries. Deadly poisonous. Plate 13, fig. 1.

This species and its various forms are the most dangerous of all poisonous mushrooms. It is often called "deadly amanita" or "deadly agaric."

The cap is fleshy, thick, viscid, slimy when wet, sometimes smooth, orbicular to bell-shaped, convex when finally expanded, yellow, white, or greenish to nearly olive. Sometimes there is only a tinge of yellow at the center of the white cap. In some cases a large part of the cap may be yellow with a deeper shade at the center. It is 5 to 11 centimeters broad. The gills are white, free, sometimes joined by only a narrow white ring to the stem. The stem is very often scaly, thick, cylindrical, varying from stout to slender, stuffed by fibrils, then hollow, white, or tinged by the color of the cap, often much lighter in color, 5 to 15 centimeters long, 6 to 10 millimeters in diameter. The ring is superior, membranous, white, evanescent. The cup is white, often olive to greenish, sometimes yellowish outside, thick, membranous, usually more or less buried in the ground. The flesh is white, olive to greenish under the cuticle. It has an unpleasant odor when young, which becomes very strong and foetid with age.

This mushroom is quite common in and around Baguio, Mountain Province. It can be found from late May to September.

Genus AMANITOPSIS Roze

This genus resembles *Amanita* in all characters, except in the absence of the ring on the stem. For instance, the movable ring (often only fragmentary) of some species of the genus *Amanita* resembles that of *Amanitopsis*. So far none of the species have been reported poisonous. Like *Amanita*, they are found in cool, damp, places in the mountains. The members of this genus are soft, white-spored, fleshy, long or slender-stemmed, growing on the ground singly or in small groups. The partial veil and annulus are absent. The stem at the base is inserted into a cuplike structure as in *Amanita*.

AMANITOPSIS FULVA (Schaeffer) Roze. Suspicious. Plate 13, fig. 2.

The cap is light brown; the disc is deeper-colored, bell-shaped, then flattened, with a small round elevation on top called "umbo," covered slightly with a few remains of the volva 3 to 8 centimeters in diameter, lined on the margin. The stem is much paler brown than the cap, beset with small scales and surrounded at

the base by a free, yellowish membranous volva, 7 to 19 centimeters long, 0.8 to 1 centimeter in diameter. The gills are free, white, tinged with yellow. The flesh is white, yellow under the epidermis.

This mushroom is not found in the lowlands. It is quite common however, on high mountains, growing under trees.

In Europe and America this mushroom is considered edible. Its edibility in this country has never been determined. As many of its characters resemble those of the genus *Amanita*, it is but prudent to let it alone, except for purposes of study.

AMANITOPSIS VAGINATA Fries. *Kabuteng daga* (Tag.). Suspicious. Plate 15, fig. 1.

This rare mushroom grows mostly in very rich soil composed of well-decayed organic matter. It is always found in humid places in thick forests. It grows solitary or in groups of very few. It can be found from late August to the latter part of December or early January, when the weather is cool and moist. The edibility of this mushroom in the Philippines has not yet been tested. Its close resemblance to the species of *Amanita* should make one careful, however, in using it for food. At best, for the present, it should be collected only for purposes of study.

This mushroom is soft and fleshy. The cap is humid or wet, striated on the thin margin and rather smooth on top, at first olive-brown, egg-shaped, then convex to plane, and gray to grayish brown. The stem is slender, white, hollow, cartilaginous, 16 to 35 centimeters long, and 6 to 10 millimeters in diameter. The gills are white, sharp, free, easily separated from the stem. The ring is absent. The volva is white, persistent, cup-shaped, with more or less irregular margin.

The color and shape of this mushroom when still undeveloped resemble the rat, whence it gets its tagalog name, *kabuteng daga*.

Genus *LEPIOTA* Fries

The generic name *Lepiota* is derived from the Greek word *lepis* meaning "scale," due to the numerous scales that are borne on the cap of many species.

The members of this genus are all white-spored, except *L. chlorospora* Copel., which has greenish spores. The cap is scaly from the breaking off of the cuticle, seldom smooth, often white, but also yellow, brown, or reddish brown. The stem is fleshy, generally hollow, easily separated from the cap, and provided with a permanent or temporary ring. The gills are free or

remote from the stem, generally white or whitish. The species grow mostly on grassy places, more often in fields than in woods. *Lepiota* is closely allied to *Amanita*, from which it differs in the absence of the volva.

LEPIOTA AMERICANA Peck. Kabuteng mamulamula (Tag.). Edible. Plate 14.

This mushroom came to the notice of the writer in February, 1933, when a sample batch was referred by a member of the staff of the College of Medicine, University of the Philippines, to the Bureau of Science for determination of its edibility, which was in doubt because of the close resemblance of this mushroom to *Lepiota chlorospora* Copel., called "payong ahas" in Tagalog, a poisonous species. The sample had been taken from mushrooms bought at Paco market, Manila. On tracing the source of the purchase, it was found that this mushroom had been collected in Pandacan, Manila, in a place which had been filled in with all kinds of refuse, generally mixed with discarded straw and manure taken from army stables. It seems that this mushroom is not well known, even in that vicinity, for only one family in that neighborhood collects it by the basket every morning, and sells it at Paco market.

To test the edibility of this mushroom a few specimens were bought at the market and cooked in the Bureau of Science laboratory. The mushroom was found delicious and a bit peppery. It was cooked in the laboratory from time to time, and several members of the division of botany ate it along with their other meals. In taste it is comparable to our most delicious mushrooms. This mushroom, because of its white spores, unlike *Volvaria esculenta* [*kabuteng ginikan* (Tag.)], and *Psalliota* species, such as *Psalliota* (A.) *perfuscus* [*kabuteng parang na may singsing* (Tag.)], and other species of this genus which also have colored spores, has the advantage of not turning the soup black or dark brown on being cooked. It keeps well in dried form, and when soaked in water before cooking, resumes its original form. No mushrooms of this kind have been seen during the numerous collection trips made by the writer. Possibly it was accidentally brought into the Philippines from abroad with animal feeds, such as hay, for the army horses. A portion of the material used for filling in the place where this mushroom was collected came as refuse from army stables.

This mushroom grows abundantly and appears from May to as late as February, depending on the length of the rainy season.

The cap is white, becoming dull brown on maturity; 5 to 14 centimeters in diameter, convex, with a central elevation when fully grown. When young, it is somewhat conical. The cuticle is at first reddish brown and continuous, but soon breaks into scales, except at the central elevation on the top. The scales are scattered and adhere closely to the surface. The margin of the cap is somewhat inrolled, divided into flaps. The gills are free, white, broad, from 7 to 9 millimeters wide. The stem is 6 to 12 millimeters in diameter above, 8 to 14 millimeters below, hollow, white, slender above the ring, becoming light brown in age. The ring is broad, very conspicuous, 2 to 2.5 centimeters from the cap. Collected in mass, the spores are white.

In appearance this mushroom is very similar to *Lepiota chlorospora*, which is poisonous. It differs however from the latter in that when bruised it turns pinkish to reddish brown, and the spores are white. The spores in mass are greenish.

The Tagalog name, *kabuteng mamulamula*¹⁷ was given it because of the characteristic change in color.

LEPIOTA CANDIDA Copeland. *Kabuteng puti* (Tag.). Not tested. Plate 15, fig. 2.

The cap is fleshy, flat, with a strongly rounded elevation on top, dry, shining, white, covered with cottony scales, 6 to 8 centimeters in diameter. The margin is thin, somewhat lined and finely cut into rounded projections. The flesh is white. The gills are free, very crowded, nearly ending in a sharp point at both ends. The stem is 12 to 16 centimeters long, 4 to 6 centimeters in diameter near the top, with a narrow axial hollow, much enlarged but not bulbous in the solid lower part, naked, shining, white. The ring is high up, dropping off at maturity. This mushroom is odorless, and of a mild taste.

This mushroom grows on the ground, singly, in sunny grass. It is found from June to September and is common in Manila. Its Tagalog name is derived from the color of the cap, which is white.

LEPIOTA CEPAESTIPES Fries. *Kabuteng may singsing*¹⁸ (Tag.). Poisonous. Plate 16.

The specific name *cepaestipes* is derived from the Latin word *cepa*, meaning "onion," and *stipes*, "stem."

This harmless-looking but poisonous mushroom is found in rich soil that is mainly composed of decaying vegetable matter. It is very resistant to drought, appearing very early and lasting

¹⁷ Turning red.

¹⁸ Mushroom with a ring.

until very late in the season. It grows in groups of a few to very many, forming a large mat on the ground.

The cap is 2.5 to 9 centimeters in diameter, thin, soft, at first egg-shaped, then bell-shaped and later expanded, covered with minute, numerous brownish scales, elsewhere white; the margin is striated and splits early. The flesh is white. The gills are free, narrow, thin, close, and white. The stem is 5 to 11 centimeters long, 7 to 9 millimeters in diameter, tapering upward, smooth, of the same color as the cap. The ring is thin, membranous, white, permanent. The spores in mass are white. This mushroom has a mild odor and taste.

This mushroom is very variable in appearance. During the early and late parts of the season it is small, and the color of the cap and of the stem darkens to light brown.

LEPIOTA CHLOROSPORA Copeland (= *L. MORGANI* Peck). Payong ahas (Tag.); oong ti takki noa'ig (Ilk.); oong na tai dueg (Pang.). Poisonous. Plate 17.

This is one of the largest mushrooms. It is widely distributed, growing anywhere, from sandy places to well-manured ground. It is hardly ever found in the forest. *Lepiota chlorospora* appears early and late in the mushroom season, generally growing in groups of a few or many individuals, but sometimes singly. It is traditionally known among the country people as poisonous. By mistake it is often included in the collection basket with the edible kinds.

This mushroom is so beautiful and attractive that anybody who knows nothing about mushrooms is apt to collect it for the table. This fact accounts for the many cases of mushroom poisoning in the Philippines. The following incident shows how cases of poisoning often occur through carelessness.

Mr. Macario Ligaya, of the Bureau of Science, an experienced collector of zoölogical specimens, went out one day on a short collecting trip. He was accompanied by a laborer who carried the collecting apparatus, a gun, and a good quantity of fire-arm ammunition. While on their way, through many fields, the collectors noticed fine, well-flavored mushrooms, *Collybia albuminosa*.¹⁹ They picked them, and at noon cooked them as part of their meal. After resting they again started to collect. The heavy load on his shoulder and on his side, plus the heavy meal he has just eaten, made the laborer lag very much behind on

¹⁹ Tag.: *Kabuteng punso*.

the way. The delicious mushroom dish was still fresh in the man's mind, so the lure of another find made him alert and vigilant. Suddenly he stopped and looked around. He noticed in a spot some white objects. They were mushrooms. Hurriedly, he stooped down and began collecting. He collected a good many to take home.

In the evening they started homeward, and it was already rather late when they got home. He at once unloaded his mushrooms and began cleaning them to cook. He asked his wife to buy wine in order to stimulate the appetite for supper. Fortunately, she had already had her supper, and besides, she was not feeling well that night. The man had to eat alone, and finished all the mushrooms that he and his wife had cooked. It was a very good supper, for the mushroom dish was as delicious as that he had eaten at noon. After leaving the table he rested awhile on a chair and then went to bed. After about two hours or so, while in bed, he began to feel an acute stomach ache. Quietly he tried to endure the pain but at last he had to call his wife. She prepared at once some hot tea, believing that it was only an ordinary case of indigestion. Soon the husband began to have cold perspiration, and to suffer from vomiting and diarrhoea. The symptoms of his trouble were the same as those of cholera. The wife became worried. She went down and reported the case at once to the collector who had been with her husband the whole day. On being told about the distress of the laborer, Mr. Ligaya asked what her husband has taken for supper. She answered that she did not remember anything he ate that night except the mushrooms he brought home. The collector was very positive that the mushroom eaten by the laborer was the *payong ahas*, which is poisonous. The only thing to be done was to call a doctor to relieve the patient from the pain.

Hence it does not pay to collect mushrooms for the table unless one is sure of their edibility. It is said that some persons can eat *Lepiota chlorospora* with perfect safety. Others, however, are susceptible to the poison and may suffer much from it.

The cap of *Lepiota chlorospora* is from 9 to 30 centimeters in diameter, soft and fleshy. At first it is nearly globose, soon becoming expanded, seldom depressed in the middle. It is generally white, but covered by a brown cuticle which breaks up into scales except at the center. When bruised, its color changes

to brownish and then to yellowish. The gills are broad, close together, entirely free, at first white, soon becoming green or greenish because of the mass of green spores adhering to them; when the gills get older they assume a yellowish color. The stem is white or nearly so, tinged with brown, smooth, firm, cylindrical, swollen at the base, sometimes tapering slightly upward, 7 to 9 centimeters long and 5 to 9 millimeters in diameter. The spores in mass are green, becoming yellowish green in age. The ring is about 1 centimeter broad, conspicuous, fixed, persistent, split in its own plane, white above until discolored by the spores.

LEPIOTA CRISTATA Fries. *Kabuteng tigre*²⁰ (Tag.). Suspicious. Plate 18, fig. 1.

This is a beautiful little mushroom that grows on the ground among grasses, frequently in gardens and lawns. It grows in groups of many or scattered. The color and the distribution of the scales on the cap resemble the stripes of the tiger, hence its Tagalog name.

The cap is fleshy, 2 to 4 centimeters in diameter, sometimes umbonate, silky, at length with nearly granular, dark-brown to rust-colored scales. The gills are crowded, white, free. The stem is hollow, thickened at the base, gradually tapering upward, pale, becoming reddish downward, with little fibrils, 2.5 to 4 centimeters long and 3 to 4 millimeters in diameter. The ring is somewhat membranous, sometimes appendaged, evanescent. The flesh is white. The odor is strong and nauseous.

This mushroom is suspected of being poisonous.

LEPIOTA GRACILENTA Krombholtz. Not tested. Plate 20, fig. 1.

The cap is nearly conical to bell-shaped, becoming umbonate when expanded, powdery, pale pinkish brown at the margin, brownish olive at the top, becoming very dark brown when bruised, 2.5 to 9 centimeters in diameter. The skin covering the cap cracks gradually into fine scales; the margin is entire, and wavy. The gills are crowded, free near the stem, white, becoming brownish when injured. The stem is cylindrical, sometimes compressed and channeled, scaly, of the same color as the cap, nearly hollow, bulbous at the base, 5 to 8 centimeters long, 6 to 11 millimeters in diameter. The ring is membranous, nearly persistent, of the same color as the stem. The flesh is white, with a pleasant odor and savory taste.

This mushroom grows on the ground under trees and is quite common in Manila. It can be found from May to September.

²⁰ Tiger mushroom.

In England it is considered edible. Its edibility in the Philippines has not yet been tested.

LEPIOTA HISPIDA Lasch. Not tested. Plate 20, fig. 2.

A beautiful mushroom growing on rotten logs in very cold places in the forests. It appears in groups, often united at the base, from May to December. The edibility of this mushroom has not yet been tested.

The cap is nearly convex, plain, umbonate, 2.5 to 4.5 centimeters in diameter, scaly, chestnut-brown to dark brown. The scales are blunt, stiff, soon becoming shaggy and especially dense at the center of the cap. The gills are white and free at the back towards the stem. The stem is cylindrical, more or less swollen at the base, of the same color as the cap, 4 to 8 centimeters long and 3 to 8 millimeters in diameter, scaly, but the scales are rare. The ring is broad, hairy, pale, rosy above and brown below. The hair is evanescent. The flesh is white, tasteless, with a typical mushroom odor. The spores in mass are white.

LEPIOTA LILACEA Bresadola. Kabuteng lila²¹ (Tag.). Not tested. Plate 18, fig. 2.

Like *Lepiota cepaestipes*, this is a drought-resistant mushroom, found early in May or even late in February. It is cosmopolitan in habit, growing in very rich soil consisting of decayed vegetable matter, in the lowlands in the forests and in the very heart of the city under acacia trees. In appearance it resembles *L. cepaestipes*, but it is much smaller, and the cap is rough and striated and later the margin is torn. Also, *L. lilacea* grows singly or in groups of very few, while *L. cepaestipes* grows in tufts of many. Only by very careful study of the characters of the two fungi can the beginner distinguish one from the other. The varied color gives this mushroom an attractive appearance. Its edibility has not yet been tested. Its small size, however, makes it not very inviting to the collector of mushrooms for the table.

The cap is 2.5 to 3.5 centimeters in diameter, fleshy, convex-campanulate, plain to depressed, sometimes umbonate, at first of a purple-lilac color, then colorless and covered with dry, beautiful, dark scales. The gills are white, free, somewhat crowded, swollen, rounded toward the stem; the edge of the gills is thready. The stem is equal in diameter throughout, hollow, fibrous, white to flesh-lilac toward the top, becoming darker downward, 2.5 to

²¹ Lilac mushroom.

4 centimeters long, 2 to 3 millimeters in diameter. The annulus is membranous, persistent, white above, dark violet below. This mushroom is odorless and tasteless.

The Tagalog name is derived from the color of the fungus.

LEPIOTA METULISPORA Berkeley and Bresadola. Not tested. Plate 19, fig. 1.

This mushroom is quite common in Manila during the rainy season, from June to September. It grows singly, on the ground under shade trees, generally under acacias. Its edibility in the Philippines has not yet been determined.

The cap is fleshy, top-shaped when young, becoming bell-shaped when expanded, covered with yellowish to very pale scales except at the center, 3 to 5.5 centimeters in diameter. The gills are white, somewhat crowded, round and free toward the stem. The stem is equal throughout, 4 to 9 centimeters long, 5 to 7 millimeters in diameter, hollow, and white, yellowish to very pale below the ring; the rest is pale. The ring is cottony, easily evanescent. The flesh is white. This fungus has a typical mushroom odor and a mild taste.

LEPIOTA sp. *Kabuteng hugis payong*²² (Tag.). Not tested. Plate 19, fig. 2.

The cap when young is nearly round to egg-shaped, then bell-shaped, later expanded, 5 to 10 centimeters in diameter with a sharp angular elevation on top, covered with grayish brown to reddish-brown skin which later breaks up into shaggy scales except on the top where it remains intact. The stem is 7 to 12 centimeters long, and 4 to 7 millimeters in diameter, cylindrical, tapering upward, enlarged at the base, of the same color as the cap. When injured, it becomes pinkish to almost reddish, a characteristic found also in *Lepiota americana*. The ring is movable and membranous.

This mushroom grows singly, scattered, or in groups of very few, on the ground, often on sandy soil under acacia trees along the road. It is quite common in Manila, most abundant during the months of heavy rains, and can be found from May to October. Its edibility has not yet been tested.

LEPIOTA DENUNDATA Rabenhorst. *Kabuteng kolor asufre*²³ (Tag.). Poisonous. Plate 21.

The cap is globose to conical when young, becoming bell-shaped to broadly expanded, thin, fleshy, 4 to 7 centimeters in diameter, sulphur yellow throughout, sometimes the center is nearly orange-colored, covered with fine, cottony scales which disappear in age; the margin is deeply striated, especially in age. The

²² Umbrellalike mushroom.

²³ Sulphur-colored mushroom.

gills are free, thin, narrow, few, white, becoming yellowish because of the scales from the cap adhering to them. The stem is hollow, bulbous, elongated at the base, sulphur yellow, 7 to 10 centimeters long, 6 to 11 millimeters in diameter. The ring is thin, early evanescent. The flesh is yellow. The odor is mild and the taste insipid.

This mushroom can be found from May to December.

A batch of this mushroom was sent by the Bureau of Health to the Bureau of Science for examination. According to an investigation conducted by an officer of the Bureau of Health, it was the cause of poisoning of four persons in Pasay, in May, 1934; one of the victims, a child, died.

Genus *ARMILLARIA* Fries

The generic name *Armillaria*, derived from the Latin word *armilla*, meaning bracelet, is probably given this mushroom because of the prominence of the ring on the stem. This genus is distinguished from *Lepiota* by the fact that the gills are adhering or nearly decurrent, and the flesh of the cap and the stem is uniform in structure. It differs from the genus *Amanita* in the absence of the volva or death cup. There is but one species of this genus known and collected by the author. So far no species of this genus has been reported poisonous.

ARMILLARIA MELLEA Fries. *Katuteng pulot pukiutan*²⁴ (Tag.). Edible. Plate 22, fig. 1.

This mushroom is a very active parasite, growing in clusters of few to many on trunks and roots of living trees. It is also found saprophytic on prostrate dead trees. The characters of this mushroom are so variable that a beginner is apt to make a mistake in identification. This mushroom is not found in the lowlands, for it grows in the mountains, where the temperature is cool and the air moist. It is rather tough and not of good flavor. It may, however, be cut into pieces and mixed with other food in cooking.

The cap is 3 to 9 centimeters in diameter, becoming nearly flat, usually slightly umbonate, at first egg-shaped or convex, soon expanded, honey-colored to nearly white, sometimes yellowish or reddish brown; the central portion is sometimes covered with brown scales, the rest naked but lined, sometimes smooth. The flesh is white. The gills are either attached squarely to the stem or extended down the stem, at first white, then stained

²⁴ Honey-bee mushroom.

with brown or rust-colored spots. The stem is 3 to 14 centimeters long, smooth or nearly scaly, elastic, hollow, spongy, white, becoming darker toward the base. The ring is variable in character, thick and persistent or thin and membranous, sometimes nearly evanescent. The spores in mass are white.

This mushroom can be found from July to December.

Genus COLLYBIA Fries

The generic name *Collybia* is derived from the Greek word *kollubos*, meaning "coin," due to the form and size of the cap which is generally small and frequently regular in form.

The species of this genus are white-spored. The cap is slightly fleshy, the margin rolled inward in youth. The gills are soft, free, interlaced, or with a sudden curve before reaching the stem. The ring and the cup are absent. The stem is either cartilaginous or with a cartilaginous rind, the central portion is fibrous or fleshy, stuffed or tubular. These mushrooms grow on wood or on the ground, often deeply rooted, sometimes arising from the hardened mass of hyphæ. Many of the species are quite firm after drying and when moistened easily revive. So far none of the species has been reported poisonous. *Collybia* sp. and *Collybia albuminosa* are considered among the most delicious mushrooms in the Philippines.

COLLYBIA ACERVATA Fries. Edible. Plate 20, fig. 3.

This mushroom grows in dense groups. The cap is 3 to 6 centimeters in diameter, fleshy, sometimes umbonate, swelling in a rounded form to rarely plane, smooth, partially transparent, lined at the margin in age, pale yellow to pink, later becoming pale. The gills are free, very crowded, straight, pinkish, round toward the stem. The stem is 5 to 10 centimeters long, 3 to 10 millimeters in diameter, hollow, reddish and white at the base, more or less rooted, somewhat compact, often grooved and scaly. The flesh is of the same color as the stem, without odor or taste.

This plant is quite common in the forests, growing on prostrate decayed trunks. It can be found from June to October.

COLLYBIA ALBUMINOSA (Bresadola) Petch. Kabuteng punso or kabuteng punño (Tag.); oong ti bunton (Ilok.); oong na ponñol²⁵ (Pang.); payungpayunñan kulog²⁶ (Pamp.). Edible. Plate 23.

Some of the local names of this mushroom suggest its habit of growing on ant hills. Its apparently spontaneous growth leads many people to believe that thunder and lightning have

²⁵ Ant-hill mushroom.

²⁶ Mushroom of the thunder.

something to do with it. This fungus generally grows in groups of many and is often found enormously abundant in a single spot. The writer has seen in Baliuag, Bulacan, over one hundred individuals collected from a single ant hill, under a large bamboo tree. In forests, in thickets, and under wild bamboos, it is found in no less abundance. This mushroom is very large. It seems to develop better in cooler and higher, humid places. In the cool, hilly towns of Cavite Province it grows extremely large. It is cosmopolitan in habit, for it is found almost anywhere, but always associated with, or near, an ant hill. Even under houses this mushroom is found.

This is one of the most delicious mushrooms. It is more or less cartilaginous on the stem and slightly fibrous and soft on the cap. It is glutinous when wet, especially in cooking. In deliciousness it is comparable to *Volvaria esculenta* [*kabuteng ginikan* (Tag.)], although not as mellow in taste. It has an earthy odor, and when cooked its flavor is similar to that of ginger. This mushroom can be dried and stored away for future use, without suffering any change in its eating qualities, and wetting or soaking in water makes it assume its original form. Unfortunately, due to its cartilaginous and fibrous character, this fungus does not make good material for the powdered product.

Collybia albuminosa is sold in larger quantities, and earlier in the season, in the Manila markets, than *Volvaria esculenta*.

The cap is 4 to 15 centimeters in diameter, tawny, becoming paler and easily broken at the margin, bell-shaped when young, plane when expanded. The stem is 5 to 19 centimeters long, 0.5 to 2 centimeters in diameter, of the same color as the cap, sometimes paler; tapering upward, cartilaginous, straight, rigid, stuffed, prolonged deeply into the ground like a tail. The gills are white, close, free, separated by a white fibrous ring from the stem. The flesh is white, fibrous, soft, elastic.

This mushroom can be found from May to December.

COLLYBIA sp. Mamarang²⁷ (Tag.); mannagado²⁸ (Ilk.). Edible. Plate 24.

This mushroom is considered the most delicious in the Philippines. It habitually grows in large numbers, often forming a matlike growth on the ground.

In shape it closely resembles *Collybia albuminosa*. It is, however, smaller and darker.

²⁷ From the word *parang*, meaning "plain." ²⁸ Increasing in number.

The cap is 4 to 13 centimeters in diameter, dark to ashy, becoming pale toward the margin, covered with very fine ash-colored hair, conical when young, becoming campanulate when expanded, sharply umbonate. The margin breaks easily into lobes. The stem is white, 5 to 15 centimeters long, 4 to 8 millimeters in diameter, tapering upward, cartilaginous, straight, rigid, stuffed, rooted, forming a taillike or spindle-shaped root. The gills are white, close, free, separated from the stem by a fibrous white ring. The flesh is white, fibrous, but soft and elastic. The spores are white and not so abundant when collected on a piece of paper.

This mushroom can be found from early June to October.

COLLYBIA DISTORTA (Fries) Gillet. Kabuteng pilipit ²⁹ (Tag.). Edible. Plate 22, fig. 2.

This common edible mushroom grows on the ground among the grasses and in places where there are many decaying leaves. It grows in tufts of several to many individuals. It can be found from June to September.

The cap is 5 to 10 centimeters in diameter, bell-shaped, then spreading, often irregular, smooth, brownish red, becoming pale in age. The gills are narrow, toothed like a saw, whitish, then spotted with brownish red, assuming a sudden curve before reaching the stem to which they are broadly attached. The stem is 8 to 12 centimeters long, irregular, densely covered with matted woolliness at the base, lined, very often twisted. The flesh is white, odorless, and tasteless.

COLLYBIA RADICATA Reihan. Kabuteng mahabang ugat ³⁰ (Tag.). Edible. Plate 25, fig. 1.

A very common mushroom growing on the ground in woods, groves, or borders of woods. It is edible and can be found from May to December.

The cap is 3 to 7 centimeters in diameter, fleshy, thin, convex to nearly plane, with the margin upturned in old plants and sometimes umbonate, smooth, viscid when moist, often with wrinkles on the surface which extend radially, varying from nearly white in some small specimens to grayish, grayish brown, or amber. The gills are white, broad, rather distinct, just reaching the stem. The stem is of the same color as the cap, though paler, usually white above, 8 to 18 centimeters long, 3 to 6 millimeters in diameter, tapering gradually above, sometimes mealy.

²⁹ Mushroom with distorted stem.

³⁰ Long-rooted mushroom.

The root is very long, tapering, often attached to some underground dead root.

This mushroom is easily recognized by the more or less flattened cap, and the long stem somewhat enlarged below and tapering off into a long slender rootlike process in the ground. It is from this rooting character that the plant gets its specific name *radicata*.

COLLYBIA VELUTIPES Fries. Edible. Plate 25, fig. 2.

This mushroom is edible. It grows on decaying stumps, logs, and roots, as well as on barks of living trees; it can be found from June to as late as November, depending on the length of the rainy season.

The cap is 2 to 6 centimeters in diameter, convex-expanded, slippery to the touch, smooth, brown, reddish yellow, usually darker at the central portion, yellowish along the margin. The gills just reaching the stem are broad, nearly distant to close, whitish or yellowish, with the edges finely fringed. The stem is 2 to 8 centimeters long, 3 to 7 millimeters in diameter, thick, firm, stuffed, then hollow, becoming velvety with short tawny or blackish-brown hair, yellow at the apex. The flesh is white or tinged reddish yellow, with a mild odor and an agreeable taste. The spores in mass are white. Ring and cup are absent.

Genus **LACTARIUS** Fries

The generic name is taken from the Latin word *lac*, meaning "milk."

The species of this genus are characterized by their habit of exuding white or colored milk when bruised. The milk is granular and of a resinous nature, and varies in taste from mild to very biting on the tongue. The cap is fleshy and regular. The gills are broadly attached or decurrent, somewhat rigid, with acute edges. Under the microscope the trama, that is, the loosely woven hyphal tissue forming the central substance of the gills or lamellæ, is vesciculose, as if composed of bladders. The stem is very rarely not at the center. The spores are white or yellowish, rarely pinkish in mass. The species of the genus grow on the ground.

In the Philippines the members of this genus are found in the mountains where it is cool and humid.

LACTARIUS VOLEMUS Fries. *Kabuteng bundok*²¹ (Tag.). Not tested. Plate 26, fig. 1.

This mushroom is not found in the lowlands. It is, however, abundant in the mountains, where it is moist and cool. It is

²¹ Mushroom in the forest.

found in great numbers on the steep banks on both sides of the road going to Atimonan, in the Quezon National Forest Park, Tayabas. This plant seems to be well adapted to sticky soil. It is one of the most beautiful mushrooms found in the Philippines, because of its form and its variegated color. It can be found from June to November, depending on the length of the rainy season.

The cap is more or less funnel-shaped, with an irregular margin, brownish orange, or much deeper brownish red, sometimes very much lighter, with the surface smooth, but velvety and often decorated with cracks. When bruised, the cap exudes milky fluid. The fluid is sticky, white, and mild in taste. The flesh is white, becoming brownish when bruised. The gills are either distant or somewhat crowded, free, white, becoming dark when bruised. The stem is 2 to 6 centimeters long, and about 1 centimeter in diameter, stuffed, of the same color as the cap. The surface of the stem is covered with fine powder except at the base. It has the same color as the gills.

The edibility of this mushroom has not yet been tested.

Genus RUSSULA Fries

The generic name *Russula* is derived from the Latin word *rus-sulus*, which means "reddish." The caps of many of the species are reddish to bright red.

This genus is closely allied to *Lactarius*, except that *Russula* does not exude milk. The cap is fleshy and regular, then depressed. The gills are fragile, rigid, attached more or less squarely to the stem; the edge of the gills is acute, the trama composed of cells shaped like gall bladders. The stem is fleshy, central. The spores in mass are white or yellow, rarely greenish.

The species of this genus in the Philippines are found in the forests, where the temperature is cool and the air humid.

RUSSULA SANGUINEA Bulliard. Kabuteng kulay dugo²² (Tag.). Suspicious. Plate 27, fig. 2.

Like *Lactarius*, this mushroom grows in damp, cool places in the mountains. It is found from June to as late as November or December. The blood-red color of this beautiful plant is very attractive in the forest.

The cap is moist, fleshy, firm, obtuse, then depressed and funnel-shaped, blood-red, becoming pale around the spreading

²² Blood-red mushroom.

acute margin. The gills are white, then cream-colored, decurrent, rarely forked. The stem is reddish, sometimes white. At first it is contracted at the apex, then equal, firm, wrinkled, sometimes channeled. The flesh is white, reddish under the cuticle.

This mushroom has a bitter taste and its edibility is doubtful.

Genus TRICHOLOMA Fries

The generic name *Tricholoma*, derived from the Greek word *thrix*, meaning "hair," and *loma*, "fiber," is due to the characteristic of certain species of this genus of having hairs or filaments on the margin of the cap.

The species of this genus are white. The cap is sticky or dry. The stem is continuous with the cap, spongy, fleshy to fibrous. The ring and volva are absent. The partial veil, if present, is slightly fibrous or cottony. The gills are notched near the stem.

Many of the species of this genus are eaten in the Philippines, although they are not of good flavor. Many members of this genus are extraordinarily large.

TRICHOLOMA sp. *Kabuteng higante*²² (Tag.). Edible. Plate 28, fig. 1.

This is an extraordinarily large mushroom. It is a rare plant, found from July to September, depending on the length of the rainy season. It grows on the ground, often under large acacia trees.

The cap is large, up to 27 centimeters in diameter, convex, expanded, white, becoming yellow to dark yellow, nearly brown toward the center, sometimes with more or less upturned and wavy margin. The gills are crowded, white, notched near the stem, or nearly free but close to the stem. The stem is up to 50 centimeters long, 3 to 5 centimeters in diameter, of the same color as the cap, solid, fibery, smooth and tapering toward the base. The base is somewhat swollen. The spores in mass are white.

This mushroom is edible. One plant is enough to provide a meal for a small family.

TRICHOLOMA PANÆOLUM Fries. *Kabuteng madaling magbago ng ayus*²⁴ (Tag.). Edible. Plate 28, fig. 2.

This mushroom commonly grows on the ground, under acacia trees along the sides of the road. It is abundant in Manila, especially during the months of heavy rains. It can be found

²² Giant mushroom.

²⁴ Mushroom of easily changing form.

from May to December, growing in tufts, sometimes solitary, but generally in groups of many.

The cap is 5 to 10 centimeters in diameter, fleshy, conical to expanded, swollen, generally wavy or here and there depressed, gray, becoming paler and somewhat silky and spotted; the margin is thin, rolled inward, and mealy. The stem is 3 to 7 centimeters long, 0.8 to 2 centimeters in diameter, at the center of the cap, sometimes asymmetrical, whitish gray, fragile, equal or gradually thinner at the base, nearly lined, provided with small fibers. The gills are 4 millimeters broad, white, then gray, very crowded and plain, with a sudden curve as if scooped out at the point of attachment to the stem, sometimes rounded, then decurrent. The flesh is grayish, becoming whitish, with a horn-colored lining at the base of the gills. The spores are whitish or of a pale dingy color in mass.

This mushroom is edible.

Genus PLEUROTUS Fries

The generic name *Pleurotus* is derived from the Greek word *pleuron* meaning "side," and *ous*, an "ear." The name suggests the shape of the mushroom, which is like the outside of an ear.

The cap is generally white among the large species, ashy greenish, yellowish, or reddish white in those of medium size; smaller forms are white-gray or blackish. The stem is lateral, eccentric or entirely wanting, except in larger-stemmed species, which are very few, where the stem is occasionally almost central.

The gills are either not easily detached, narrowly attached, or decurrent. The veil is absent. All species are known to be edible and of pleasant flavor, when properly prepared. Many of the species of this genus emanate light at night like the ordinary firefly, hence the Ilocano name *anandap* and the Tagalog *alitaptap*, the common names for the firefly.

The members of this genus grow in clusters, or aggregates of individuals, constituting attractive complex brackets or combs. They grow on decaying trunks and fallen logs of many trees. No species of this genus are suspected of being poisonous. The type of this genus is *Pleurotus ostreatus*.

PLEUROTUS CANUS Quelet. *Alitaptap* (Tag.); *anandap* (Ilok.). Edible. Plate 29.

A very common mushroom growing abundantly on rotten trunks of banana. It is very small, but conspicuous, because of

its habit of growing in large numbers and its white color. It can be found from May to October.

The cap is 2 to 4 centimeters in diameter, thin, membranous, shelflike, kidney-shaped, the margin often divided in rounded forms, white, gray, striated or lined. The gills are distant, swollen, white, fringed at the edge, touching broadly at the stem. The stem is white, 3 to 6 millimeters long, 1 to 2 millimeters in diameter, curved, solid. The flesh is white, odorless and tasteless.

PLEUROTUS CORNUCOPIÆ (Persoon) Boudier. Alitaptap (Tag.); anandap (Ilk.). Edible. Plate 30, fig. 1.

The cap is 6 to 12 centimeters in diameter, fleshy, regular to eccentric, convex, funnel-shaped, dark gray, or yellow, grayish yellow, becoming white. The gills are white, then dirty yellow, crowded, broad, decurrent, sometimes so much so that the stem looks somewhat grooved. The stem is solid, white, finally of the same color as the cap; the base is white, more or less hairy, 1 to 4 centimeters long, 2 to 5 millimeters in diameter. The flesh is white, savory, of somewhat mealy odor.

This plant grows in mushroom beds composed of waste abacá fiber.

PLEUROTUS LIMPIDUS Fries. Alitaptap (Tag.); anandap (Ilk.). Edible. Plate 30, fig. 2.

A common mushroom growing in bunches on old trunks of the pandan and the coco palm. At night it gives off a phosphorescent light which resembles that of the firefly.

The plant is glassy white, shining white when dry. The cap is powdery, 2 to 3 centimeters in diameter, inversely egg-shaped, horizontal, narrowed behind into a stemlike base; the margin is sharply turned inward, very thin. The gills are decurrent, crowded, thin, and linear. The flesh is white, with a pleasant odor and an agreeable taste.

PLEUROTUS OPUNTIE de Durian and Lévêille. Alitaptap (Tag.); anandap (Ilk.). Edible. Plate 31, fig. 1.

A beautiful white mushroom, growing on fallen trunks of trees in thick forests. It grows abundantly, appearing like a white cottony mat that covers a large surface of the trunk. On the under side where the gills are located, the stems of many individuals are attached to each other in an overlapping position with a common center.

The cap is 4 to 10 centimeters in diameter, fleshy, glowing white, sharply lobed, becoming torn when old. The stem is

short. The gills are snow white, close, decurrent. The flesh is white, tender, with a mild taste, and an odor of disintegrated wood.

This mushroom is edible, and can be found from June to October. It emanates a phosphorescent light in the dark.

PLEUROTUS OSTREATUS Fries. Malaking alitaptap (Tag.); dakkell n̄ga anandap⁸⁵ (Ilk.). Edible. Plate 30, fig. 3.

The specific name *ostreatus* is Latin, meaning "oyster." The Americans call this species "oyster mushroom," due to its oyster-like form.

This mushroom grows on stumps and prostrate trunks, including living trees. It appears in crowded clusters, often with caps that overlap each other. Sometimes the stem is so short that it appears absent; at other times it is very prominent. This is a delicious mushroom, not hard to identify even for the beginner. The young plants only should be used in cooking. After thorough cleaning and washing, they are torn into pieces, dipped in beaten egg, and fried in hot lard.

The cap is 5 to 14 centimeters in diameter, varying from white to gray or brown, fleshy, soft, thick at the center where the stem is attached, becoming thin toward the margin; the surface is moist or dry, smooth, sometimes more or less torn into scale-like appendages. The gills are broad, white, not crowded, narrowed out into veinlike branching lines connecting with each other, decurrent. The stem, when present, is short, firm, white, often thickened upwards, sometimes hairy. The ring and the cap are absent. The spore print on black paper is white to lilac.

PLEUROTUS PORRIGENS Persoon. Alitaptap (Tag.); anandap (Ilk.). Edible. Plate 31, fig. 2.

This is a wood-inhabiting fungus, growing on prostrate trunks of trees, especially the bagtikan. At night this beautiful mushroom emanates phosphorescent light. It is edible.

The cap is 2 to 6 centimeters in diameter, fleshy, glowing white, smooth, turning upward and bending back, without stem or stalk. The gills are white, sparse, decurrent. The flesh is white, odorless, with a mild mushroom taste.

This mushroom is found from June to September, depending on the duration of the rainy season.

⁸⁵ Large firefly mushroom.

PLEUROTUS PULMONARIS Fries. Alitaptap (Tag.); anandap (Ilk.). Edible. Plate 31, fig. 3.

This is also a wood-inhabiting mushroom, being very common in humid forests, where it grows in tufts. This species of *Pleurotus* gives out beautiful light at night.

The cap is 3 to 5 centimeters in diameter, fleshy, lateral, inversely egg-shaped, gray to grayish yellow. The gills are crowded, white, then nearly of the same color as the cap, decurrent. The stem is very short, sometimes lacking, white, provided with a few hairs at the base. The flesh is white and soft, with a pleasant odor and an acid taste.

This mushroom is edible, and is generally found from June to September.

PLEUROTUS ULMARIUS Fries. Alitaptap (Tag.); anandap (Ilk.). Edible. Plate 27, fig. 1.

This mushroom grows in the woods, solitary or in tufts, on decayed wood of bagtikan, often from a crack or wound of a living tree. It can be found from May to December.

The cap is compact, firm, convex, then expanded, moist, smooth or somewhat hairy, white or whitish, becoming dull leather-colored and cracked in age. The gills are broad, with a sudden curve before reaching the stem or just reaching the stem, becoming rounded behind, close to nearly distant, white or whitish. The stem is 3 to 5 centimeters long, 5 to 12 millimeters in diameter, variable, eccentric, sometimes central, stout, solid, firm, whitish, smooth or slightly hairy, straight or curved. The odor and taste are pleasant.

Genus CLITOCYBE Fries

The generic name is derived from the Greek word *clitos*, meaning "sloping," and *cybe*, "head," and refers to the shape and the position of the gills which are decurrent.

The cap is usually fleshy, plane, depressed, or funnel-shaped, rolled inward at the margin. The gills are generally decurrent, sometimes broadly attached to the stem. The stem is fibrous, elastic, spongy, stuffed, sometimes hollow, never cartilaginous. The cup and ring are absent. The spores in mass are white.

CLITOCYBE LUSCINA Fries. Plate 32, fig. 1.

A common mushroom growing on the ground and in groups, generally under bamboo trees. Its edibility in the Philippines has not yet been determined, but in Europe it is considered safe to eat. It can be found from June to September.

The cap is 2 to 3½ centimeters in diameter, fleshy, somewhat sticky when wet, convex, sometimes depressed at the center, dark, turning pale, nearly brown, becoming ashen, hairy at first, then smooth. The gills are fine, crowded, pale, broadly attached or nearly decurrent. The stem is 3 to 5 centimeters long, 4 to 5 millimeters in diameter, somewhat equal to nearly tapering toward the base, more or less fibrous, white, becoming darker at the base, slightly powdery, later smooth. The flesh is white, with a pleasant odor and a mild taste.

CLITOCYBE MULTICEPS Peck. Edible. Plate 33, fig. 1.

This mushroom grows on the ground, usually in grassy places and sometimes under bamboo trees, in clusters of from ten to as many as thirty or more individuals. It is common, often abundant, and may be found from May to October.

The cap is 3 to 5 centimeters or more in diameter, convex or sometimes nearly flat, often irregular from mutual pressure, white, gray, or brownish gray, smooth, dry, fleshy; the flesh is not very thick at the center, and very fine; the surface is smooth or sometimes slightly silky toward the center, moist in wet weather. The flesh is white, with an oily taste which is somewhat disagreeable. The gills are whitish, close together, narrow at each end, and attached to the stem either squarely or slightly extending down the stem. The stem is 8 to 20 centimeters long, 0.8 to 3 centimeters in diameter, cylindrical, firm but more or less elastic, smooth on the outside but sometimes covered with a cottony substance. Ring and cup are absent. The spores in mass are white.

This mushroom is edible.

CLITOCYBE PHYLLOPHYLLA Fries. Kabuteng embudo⁸⁸ (Tag.). Not tested. Plate 32, fig. 2.

A very common mushroom that grows on the ground, often in large numbers. It is very soft and easily decays. The plant can be seen from June to November.

The cap is fleshy, 2.5 to 6 centimeters in diameter. The gills are decurrent. The stem is 2.5 to 3.5 centimeters in diameter, spongy to fibrous, stuffed, then somewhat hollow and cream-colored. The apex of the stem is somewhat covered with whitish silk, while the base is hairy to nearly woolly. The flesh is white and tasteless. The odor, if present, is somewhat nauseous.

This mushroom is not known to be edible.

⁸⁸ Funnel-shaped mushroom.

Genus SCHIZOPHYLLUM Fries

The generic name is derived from the Greek word *schizo*, meaning "to split," and *philo*, "leaf." The name is appropriately given because of the shape of the fungus, which is that of a leaf, and the gills are split.

This is a very interesting genus, consisting of only a few species, of which only one is known in the Philippines. The members of this genus are flexible and fresh, but tough when dry. The spores are white. The gills are split along the edge and generally strongly rolled back. The cap is thin and leathery. The stem is lateral or absent.

SCHIZOPHYLLUM ALNEUM Linnaeus (= **SCHIZOPHYLLUM COMMUNE** Schroet). Cudet (Ilk.); kuñas or sigdot (Tag.). Edible. Plate 33, fig. 2.

A very common mushroom in the Philippines, growing on woods and bamboos. It is found all year round, although most abundantly during the rainy season. The name *Schizophyllum alneum* has priority over *S. commune*.

The cap is 1 to 3 centimeters in diameter, white, hairy or woolly, or with coarse, white hair, often much lobed at the margin, toward the stem commonly forming a stemlike base. The gills are white, woolly, branching out toward the margin of the cap like the radiation of a fan, deeply split along the edge and strongly rolled backward.

During dry weather this mushroom is much shrunken and curled up, but in rainy weather it expands quickly and looks very beautiful. The spores leave a print that is whitish to pinkish white.

In the Philippines especially the Ilocanos eat this mushroom. It is prepared like the species of *Auricularia*, by soaking in water before cooking. It is rather tough but makes excellent soup.

Genus OMPHALIA (Persoon) Fries

The members of this genus have fleshy or somewhat thin and pliable caps. The stem is central, cartilaginous. The gills are decurrent. The spores in mass are white, rarely yellowish. The plants are mostly small and grow usually on twigs and woods. Few are of sufficient size to be collected for eating; none are, however, known to be poisonous.

OMPHALIA RECLINIS Fries. Not tested. Plate 26, fig. 2.

The cap is 1 to 3.5 centimeters in diameter, membranous, convex, nearly funnel-shaped; the margin is lined or grooved, dark

to ash-colored. The stem is short, 1 to 2.5 centimeters long, 2 to 4 millimeters in diameter, tough, cartilaginous, dark, becoming pale to nearly of the same color as the cap. Ring and volva are absent. The gills are narrow, pale to nearly the same color as the cap, decurrent, crowded in young plants but becoming more distant as the cap expands. The spores in mass are white.

This mushroom is quite abundant in the forests during rainy season, growing on decayed wood and old bamboos. It is somewhat tough to leathery. It has a mushroom odor and an agreeable taste.

Genus MARASMIUS Fries

The generic name is derived from the Greek word *maraino*, meaning "to wither" or "shrivel;" a character of this genus is to dry or shrivel instead of decay.

This genus resembles *Collybia*. It differs from it, however, in that it shrivels in dry weather and expands again when moistened. The mealy odor that is common in the genus *Collybia* is absent from this genus. The garlic or onion smell, however, is present in *Marasmius* and absent in *Collybia*. The cap is dry, flexible, somewhat thin. The gills are simple, pliable, nearly distant, with acute, entire edges. The stem is cartilaginous or horny. The species are usually small, thin and epiphytic. Those that appear to grow on the ground are generally rooting on decaying leaves or roots of grasses.

MARASMIUS HAEMATOCEPHALUS Montagne. Kabuteng mukang balat ⁸⁷ (Tag.). Edible. Plate 34, fig. 1.

This mushroom is common on rotten logs and old bamboos. It grows in large numbers, but never united. It is edible. The plant can be found during the rainy season, from May to November.

The cap is 1 to 2 centimeters in diameter, membranous, conical, convex, folded into plates, blood-red, turning pale yellow to somewhat tawny or brown, later becoming reddish; the margin has more or less rounded projections. The gills are pale, few, strongly distant, broadly attached to the stem at the back. The stem is 3 to 5 centimeters long, 1 to 3 millimeters in diameter, cartilaginous, hollow, smooth, brown, round, and enlarged at the base. The flesh is of the same color as the gills, odorless, and tasteless.

⁸⁷ Leather-colored mushroom.

MARASMIUS PILOPUS Kalchbrenner. Plate 34, fig. 2.

A very common mushroom growing on wood and old bamboos in the forests. It is rather small to be collected for the table. It shrivels in dry weather and revives with moisture. It has an odor similar to that of garlic or onion. It can be found all year round, but is most abundant from May to November or December.

The cap is 0.8 to 2.5 centimeters in diameter, leathery, membranous, somewhat convex, blunt or plane to depressed at the center, radially striated or channeled, brownish, turning pale. The gills are broadly attached to the stem, moderately crowded; edge entire. The stem is 2.5 to 5 centimeters long, 1.5 to 4 millimeters in diameter, curved, stuffed to hollow, covered with fine hair, bulbous at the base, tawny to pale yellow.

Genus *CANTHARELLUS* Fries

The name *Cantharellus* is derived from the Greek word *kantcharos*, meaning "vase" or "cup," which the mature cap of this mushroom resembles.

The cap is fleshy or membranous, regular, not at the center, sometimes lacking. The gills are generally forked in pairs once or several times, tough, sometimes irregular, usually narrow, in many species resembling veins, folds, or wrinkles, although in some species they are either thin or broad. The spores in mass are white or yellowish-tinged.

The species generally grow on the ground and sometimes on wood. There are few species in the Philippines.

CANTHARELLUS AUREUS Berkeley and Curtis. Kabuteng damuhan.⁵⁵ (Tag.). Edibility not tested. Plate 35, fig. 1.

This mushroom commonly grows on the ground, often on the lawn, in groups and united at the base, from June to October.

The cap is 3 to 6 centimeters in diameter, depressed at the center to funnel-shaped, yellowish to watery brown, light wood brown when dry; the margin is wavy or with rounded division. The stem is thin, 0.5 to 2 centimeters long, 0.5 to 1.2 centimeters in diameter, of the same color as the cap, hollow, compressed. The gills are decurrent, narrow, blunt, irregularly forked, ridge-like, distant, of the same color as the cap. The spores in mass are white to yellowish. This mushroom is odorless and tasteless.

The edibility of this mushroom has not yet been tested.

⁵⁵ Mushroom in the grass.

Genus PANUS Fries

The generic name *Panus* was taken from the Latin where it connotes "tumor." Pliny used the name for a fungus inhabiting a tree, as do the members of this genus.

The species of this genus are white-spored, fleshy, leathery, and tough. After drying, they revive when soaked in water. The texture is fibrous. The flesh varies from tough to somewhat fleshy in some species. The cap is usually covered with hair or a few scales. The gills have entire edges. The stem is eccentric, lateral, or lacking.

Panus is closely allied to *Lentinus*, differing principally in the gills which are somewhat soft at first and are not provided with teeth on the edge.

PANUS RUDIS Fries. Kulatkulat na morado⁸⁰ (Tag.). Plate 36, fig. 1.

This mushroom is common in woods, especially in areas where stumps abound. It grows on stumps and prostrate trunks of trees. It is edible but rather tough and hairy. The plant is odorless and at times somewhat bitter.

The cap is 2 to 7 centimeters in diameter, irregular, depressed at the center or nearly vase-shaped; the margin is lobed and broken in age. The stem is eccentric or somewhat lateral, tough, hairy, pale tan, or pinkish to reddish brown.

This mushroom can be found from May to September.

Genus LENTINUS Fries

The members of this genus are abundant in the Philippines, and almost every one of the species grows on wood. Many are edible. The flesh, however, is rather tough in most cases. The very young tender plants should be used for cooking. Many of them are wood-rotting fungi.

The cap is fleshy, leathery, flexible, or hard and persistent. The stem is soft to hard, central, eccentric or lateral. The ring is present in some species. The gills are decurrent, not easily detached, thin or membranous, and sometimes rather tough; the edge is acute, usually serrate or irregular.

The members of this genus generally grow in tufts of many, although some are found solitary.

This genus is almost identical with *Panus*, except that the gills are plane. It is distinguished from *Pleurotus* by the hard flesh and the wavy gills.

⁸⁰ Lilac-colored mushroom.

LENTINUS AURACARIÆ Hariot and Patouillard. Kulatkulat bundok (Tag.). Edible. Plate 35, fig. 2.

A common mushroom in the forests, growing on old wood, especially on stumps, from May to December. Its favorite host is the bagtikan. The young and tender plants are edible; later in age they are too tough. Cooked in soup, this mushroom is delicious. Many species of *Lentinus* are found in the Philippines, and none of them are known as poisonous. This mushroom grows in groups, each group containing several mushrooms. Sometimes a few of them are united at the base of the stem.

The cap is 8 to 12 centimeters in diameter, leathery, membranaceous, tawny to pale, depressed at the center; the margin is entire when young, torn in age. The gills are numerous, crowded, squarely attached to the stem or nearly decurrent; the edge is entire. The stem is 3 to 4.2 centimeters long, 0.8 to 1.2 centimeters in diameter, stout, solid, hard outside. The spores in mass are white.

LENTINUS ELMERIANUS Lloyd. Kulatkulat bundok (Tag.). Edible. Plate 37, fig. 1.

This mushroom grows on putrescent wood, frequently on bagtikan. It is edible when young and tender. When old, it is tough and leathery and lacks flavor. This fungus is common in the mountains and can be found from May to November.

The cap is 6 to 10 centimeters in diameter, fleshy, later leathery, tough, rigid, funnel-shaped, regular and even, becoming torn in age, yellow to pale, covered with small appressed scales. The gills are fine, numerous, close, decurrent. The stem is 2 to 4 centimeters long, 3 to 6 millimeters in diameter, brown to dark brown, stuffed to hollow, hardened on the surface. The ring is absent. The spores in mass are white.

LENTINUS EXILIS Klotzsch. Kulatkulat kanayan (Tag.). Edible. Plate 38.

This mushroom has the best eating qualities of all the species of the genus *Lentinus*. Cooked in soup, it is more delicious than many other edible mushrooms in the Philippines. The flesh, however, is rather tough, so that only the young and tender plants are recommended for cooking. Because of its toughness and its place of abode, the Tagalog name of this plant was taken from the word *makunat*, meaning "tough," and *kauayan*, which means "bamboo." This mushroom is very common and popular everywhere. It is sold in the market in large quantities, and at a lower price than *Collybia albuminosa* or *Volvaria esculenta*. It grows on wood, but more generally on burned stumps and roots of bamboos, in groups, with the stems often united at the base.

A large mushroom. The cap is rigid, funnel-shaped, regular, even at the margin but broken in age, pallid, white to pale brown at maturity. The stem is pale brown to brown, 5 to 9 centimeters long, 0.8 to 2 centimeters in diameter, solid but pithy inside, somewhat hard outside. The gills are somewhat crowded, very decurrent, nearly equal in length, of the same color as the cap.

This mushroom can be found from May to December.

LENTINUS FUSCO-PURPUREUS Kalchbrenner. Kulatkulat na may balahibo⁴⁰ (Tag.). Plate 39, fig. 1.

This mushroom grows on rotten logs and stumps. It is common in the forest but very rare in the lowlands. It can be found from May to November.

The cap is 4 to 6 centimeters in diameter, hairy, leathery, convex, purple-brown, darkish brown, then all dark brown, sunken in the center, becoming funnel-shaped. The gills are fine and crowded, lighter in color than the cap. The stem is 5 to 8 centimeters long and 5 to 9 millimeters in diameter, hairy.

This mushroom smells like rotten wood, is tasteless, and too tough to be edible.

LENTINUS INFUNDIBULIFORMIS Berkeley. Kulatkulat bundok (Tag.). Plate 36, fig. 2.

A very large mushroom growing on putrescent wood, especially on bagtikan, frequently in moist places in the forests. It is found almost the year round, but is more common from May to December. It is hairy and rather tough. The specific name *infundibuliformis*, meaning funnel-shaped, refers to the form of the mushroom itself.

The cap is 7 to 15 centimeters in diameter, papery, rigid, regular and even when young, becoming wavy and irregular in age, pallid tawny, covered with dark hair on the surface. The gills are crowded, very fine, nearly equal, pale, decurrent. The stem is a continuation of the cap downward, dark tawny, covered with dark hair, 8 to 17 centimeters long, 0.8 to 1 centimeter in diameter, becoming curved on the lower portion.

LENTINUS PRÆRIGIDUS Berkeley. Kulatkulat bundok⁴¹ (Tag.). Edible. Plate 40, fig. 1.

A common mushroom, found in the forest from May to September. It grows on rotten logs in groups of several to many. The plant is edible but tough.

The cap is 5 to 12 centimeters in diameter, powdery to hairy, tough, funnel-shaped, pale cream, darkening towards the stalk.

⁴⁰ Tough, hairy mushroom.

⁴¹ Mushroom in the woods.

The stem is 1.5 to 4 centimeters long, and 6 to 9 millimeters in diameter, rather short, rust-colored, darkening toward the base. The gills are bright rust-colored, deep, decurrent, and somewhat far apart.

LENTINUS RAMOSII Lloyd. Kulatkulat bundok (Tag.). Edible. Plate 37, fig. 2.

A wood-rotting mushroom, attacking dead and living trees and very common in the forests. Its favorite host is the bag-tikan. This mushroom has the habit of growing in groups, often united at the base. It is attached to the host with well-developed roots. This fungus is edible, and can be found from May to October.

The cap is often torn, membranous, thin, pliable, smooth, pale to cream-colored, 2.5 to 8 centimeters in diameter. The gills are fine, numerous, crowded, thin, decurrent, with even edges. The stem is a continuation of the cap, smooth, stuffed, hard on the surface, often eccentric, 3 to 7 centimeters long, 4 to 7 centimeters in diameter, of the same color as the cap.

LENTINUS SAJOR-CAJU Fries. Kulatkulat na may singsing⁴² (Tag.). Edible. Plate 40, fig. 2.

A common mushroom that grows on dead wood and roots of dead trees. It is a wood-rotting fungus found both in the lowlands and in the forests. It grows in groups of many, often united at the base of the stem. It is edible and tender when young, becoming tough in age. It is a very early mushroom, appearing from the middle of April to December.

The cap is smooth, somewhat soft to leathery, sunken at the center, then funnel-shaped, at first white, then grayish yellow, brownish, and finally tawny-brown, 4 to 10 centimeters in diameter. The gills are white, decurrent. The stem is uniform in width, smooth, of the same color as the cap, 2 to 5.5 centimeters long, 4 to 6 millimeters in diameter. The ring is present, but movable. The flesh is white, odorless, and tasteless.

LENTINUS SQUARROSULUS Berkeley and Curtis. Kulatkulat na may kaliskis⁴³ (Tag.). Edible. Plate 39, fig. 2.

This mushroom is found in tufts. It grows on prostrate trunks and rotten boards. It is edible, but a little tough. It can be found from May to December. It is more common in the forests than in the lowlands.

⁴² Tough mushroom with a ring.

⁴³ Tough scaly mushroom.

The cap is membranous, leathery, slender, funnel-shaped, white, becoming light brown in age, covered with few, acute, curved scales that make the surface a little rough, 3 to 6 centimeters in diameter. The stem is slender, solid, woody, from 2 to 3.5 centimeters long. The gills are very slender, crowded, two-forked, decurrent, of the same color as the cap. The flesh is white, without odor or taste.

THE PINK-SPORED AGARICS

The spores of this group in mass are rosy pink, salmon-colored, or reddish. Many species of this genus are edible. *Volvaria esculenta* (Tag. *kabuteng ginikan*), which belongs to this group, is considered one of the most delicious mushrooms in the Philippines.

Genus VOLVARIA Fries

The generic name *Volvaria* is taken from the Latin word *volva*, meaning "wrapper." The members of this genus when young are surrounded by a sheathlike envelope that eventually becomes the cup or the volva in the mature plant.

The genus is characterized by the rosy or reddish spores, the presence of the volva and the absence of the annulus. The stem is easily separable from the cap at the junction; in this respect it is similar to *Amanita*, *Amanitopsis*, and *Lepiota*. The gills are usually also free from the stem. The species grow on many rotten plants, such as banana, abacá, rice straw, and wood, on richly manured ground and on leaf moulds. The species are soft in texture and decay easily.

VOLVARIA CINERESCENS Bresadola. Kabuteng bulok na kahoy⁴⁴ (Tag.). Not tested.
Plate 41, fig. 1.

This beautiful little mushroom grows from June to December, on well-rotten wood in moist places. It is found single, but sometimes in groups of several.

The cap is 2 to 3.5 centimeters in diameter, fleshy, slender or bell-shaped in youth, becoming convex at maturity; the margin is lined or grooved. The gills are free, crowded, swollen, rounded at the back, dilutely flesh-colored. The stem is 4 to 5 centimeters long, 3 to 6 centimeters in diameter, white, solid, stuffed and cylindrical, slightly swollen at the base, gradually

⁴⁴ Mushroom on rotten wood.

narrowing upward. The volva is membranous, loose, with irregular margin, white inside, ash-colored outside. The spores in mass are flesh-colored, becoming tawny. The flesh is white and odorless.

VOLVARIA ESCULENTA Bresadola. Kabuteng ginikan or kabuteng saging (Tag.); oong ti garami or oong ti saba (Ilk.); oong na punti or oong na dayami (Pang.). Edible. Plate 42.

This beautiful mushroom is found almost any place where decayed vegetable matter, such as that of banana or abacá, rice straw, corn stalks, or bagasse accumulates. It is a scavenger plant, occurring in large numbers behind houses and in back yards where waste of all kinds is thrown. In regions like the Bicol provinces, where there is precipitation almost all year round, this mushroom grows in abundance on piles of decayed trunks or remnants of abacá. In the forests it is often found under trees, where plenty of well-decayed leaves and wood have accumulated.

This mushroom is the one cultivated in the Philippines. Its good eating qualities, the ease of securing material for culture, and its adaptability to the climate of this country, help to encourage the people in its cultivation on a large scale. For taste, it is excelled by few mushrooms. It is mellow and soft, especially when cooked in the button stage or just after it has opened. The odor depends on the kind of substratum it is grown on; if it is grown on banana it has a banana odor; if on rice straw, it has the odor of rice, and so on. It can be dried easily and stored without detriment to its taste and flavor. It can also be canned or bottled. In the Philippines even poor families keep this mushroom at home for their use, rather than to sell it in the market, where it commands a good price, bringing as much as 5 centavos a large piece in the Manila markets.

The cap is 4.5 to 16 centimeters in diameter, brownish, almost plane, sometimes umbonate, then convex. When old it is fragile and bears fine hairlike scales on the surface. The flesh is white, turning brown when dried. The gills are free, thin, white, becoming brown after long exposure to air. The stem is 5 to 14 centimeters long or much longer, 0.6 to 2 centimeters in diameter, solid, fleshy, white, tapering towards the top and becoming pale brown when old. The volva is distinct, mummy brown. The ring is absent. The spores in mass are pale brown, nearing dark pink.

VOLVARIA PRUINOSA Graff. Edible. Plate 43, fig. 1.

The cap is 3 to 6 centimeters in diameter, at first round to half round, becoming flat when expanded, fleshy, soft, white, smooth, shiny, with a thin, white margin through which can be seen the rosy color of the spores beneath. The gills are free from the stem, fleshy, fragile, well-rounded, pale, soon becoming rosy in color. The stem is white, erect, 4 to 6 centimeters long, with a slightly enlarged base, on the base with a small volva; the diameter at the base is 7 to 10 millimeters, and near the middle, 5 to 6 millimeters. The cup is white, roundish, 9 to 11 millimeters in diameter. The spore print is rose-brown.

This mushroom grows on the ground, sometimes on sandy places near the beach under the shade of pandan trees. It is also very common in Manila. It can be found from June to October.

Genus **PLUTEUS** Fries

Pluteus is a Latin word, meaning "shed for the sentinel." The name is given to the species of this genus because of the similarity of the cap to a turret or sentry box used in the army for the guard.

The members of this genus have pink spores. The genus resembles *Volvaria*, but the cup is absent. The ring is also lacking. The stem is fleshy to fibrous, not cartilaginous, separated easily from the cap. The gills are free, soft, and rounded at the back.

PLUTEUS CERVINUS Fries. Not tested. Plate 41, fig. 2.

This mushroom is edible in the United States, but not in Europe. Its edibility in the Philippines has not yet been tested. It grows on the ground under trees and banana plants, and can be found from July to October. This mushroom resembles *Volvaria esculenta* very much, except that in the latter the volva is present, whereas it is absent in *Pluteus cervinus*. Neither mushroom has a veil or a ring.

The cap is fleshy, at first bell-shaped then expanded, somewhat sooty to brown, sometimes dark yellow, nearly fragile, 4 to 11 centimeters in diameter; the surface usually is smooth, but showing dark radiating fibrils, sometimes more or less scaly. The gills are free, not crowded, broad, at first white, then becoming pinkish with the maturity of the spores. The stem is solid, firm, nearly equal in diameter throughout, stuffed, ghastly white,

smooth or sometimes scaly, often enlarged at the base, 6 to 11 centimeters long, 5 to 11 millimeters in diameter. The spores in mass are pink to pinkish brown.

PLUTEUS LONGISTRIATUS Peck. Kabuteng kahoy⁴⁵ (Tag.). Not tested. Plate 43, fig. 2.

This mushroom grows on decaying logs, in damp places, generally in the forest. It collapses easily and soon decays.

The cap is very thin, convex when expanded, pale brownish gray to brownish ashy, plicated or grooved, 2.5 to 5 centimeters in diameter, minutely scaly on the disc at the cuticle; at length the cuticle breaks off in tiny particles. The stem is equal in diameter throughout, solid, thick, and fibrous, 3 to 5.5 centimeters long, 2 to 4 millimeters in diameter. The gills are free, close, rather broad, white, then pale flesh-colored due to the spores, almost uniform and crowded near the stem. The spores in mass are pinkish.

THE YELLOW-SPORED AGARICS

The color of the spore print on a white sheet of paper is either light yellow, rusty, rusty brown, or some shade of yellow.

While there are members of this group that are edible, no doubt there are some that are poisonous. As the edibility of none of them has not been established in the Philippines, it is necessary to be cautious in collecting any member of this genus for the table.

Genus *CORTINARIUS* Fries

The generic name *Cortinarius* is derived from the Latin word *cortina*, meaning "veil."

This genus is distinguished by the presence, in the younger stage, of a cobweblike veil which connects the edge of the cap with the stem. The veil is superficial in nature, not touching the gills. There is also frequently a universal veil which, on collapsing, leaves a ring or sheath on the stem. The cap is fleshy and decays easily. The stem is spongy to fleshy, sometimes rigid and somewhat cartilaginous. The gills are dry and lasting, and when young may be white, yellow, gray, olive, blue, violet, purple, red, or brown, but at maturity they become discolored due to the cinnamon or rusty brown spores that are sticking on them. The gills are either attached to the stem

⁴⁵ Mushroom on wood.

with a sudden curve before reaching the stem, or running down the stem.

CORTINARIUS COLLISTEUS Fries. Kabuteng kalauangin (Tag.). Suspicious. Plate 44, fig. 1.

This is a very beautiful plant. When fresh it is cinnamon in color, but paler at the margin of the cap, and in drying it becomes brick-colored. It occurs on wood, old bamboos, and on decaying leaves.

The cap is 3 to 10 centimeters in diameter, half-round at first, then convexly expanded, with a broad circular elevation at the center. The gills are moderately crowded, broadly attached to the stem, at first pale brown, then cinnamon-brown. The stem is slender, often curving, nearly cartilaginous, 4 to 8 centimeters long, and 5 to 9 millimeters in diameter. The veil in youth cover the gills without touching them, connecting the cap and the stem. The cortina or universal veil is white, never leaving a ring on the stem, in age the remnants of the cortina remaining hanging on the margin below the cap. The spores in mass are cinnamon-brown.

This mushroom grows separately or in clusters of several to many, from June to October. It has a mild odor and taste. The Tagalog name applies to the character of this mushroom of becoming easily rust-colored, because of the spores that are sticking on the surface.

Genus *GALERA* Fries

The generic name is derived from the Latin word *galerus*, meaning "cap," and has reference to the shape and position of the cap on the stem.

The cap in youth is bell-shaped or egg-shaped, conical when expanded, fitting straight against the stem. The stem is smooth, a little paler in color than the cap, sometimes lined or grooved, cartilaginous, hollow, with mealy whitish particles on the upper part, often very fragile. The gills are either narrowly or broadly attached to the stem, or just reaching the stem.

The species are generally small, slender, and fragile. They grow on the ground.

GALERA TENERA Fries. Kabuteng payat ang tangkay⁴⁰ (Tag.). Not tested. Plate 44, fig. 2.

This slender mushroom is common on lawns and pastures from June to December. It grows scattered and appears on the ground in a more or less spontaneous manner.

⁴⁰ Mushroom with a slender stalk.

The cap is bell-shaped, 1 to 2.5 centimeters in diameter, pale when moist, rust-colored or brown, becoming light brown as it dries off in the sun, generally smooth, although occasionally some specimens are covered with very fine, short silky hairs. When the cap is damp, it is usually slightly lined or grooved; the lining disappears as the cap dries. The stem is 7 to 12 centimeters long, 1.2 to 3.5 millimeters in diameter, slender, straight, fragile, hollow, nearly of the same color as the cap, usually shiny and more or less lined toward the top. The ring and the cup are absent. The gills are attached to the stem, somewhat broad, dark brown, more or less toothed at the edge. The spores in mass are dark rust-colored.

Genus NAUCORIA Fries

This genus agrees in structure with *Collybia*, but has rusty-colored spores. The cap is more or less fleshy, convex or conical, becoming flat; the margin at first is incurved and usually even. The stem is nearly cartilaginous, hollow, or stuffed. The gills are free, or broadly attached to the stem, never decurrent.

The members of this genus grow on the ground or on dead wood, sometimes rooting. They are usually small, and in the Philippines none of them are known to be edible.

NAUCORIA SEMIORBICULARIS Fries. Kabuteng kinalauang⁴⁷ (Tag.). Plate 45.

The cap is fleshy, convex, plane to umbonate, silky, pale yellow to somewhat dull yellowish brown, 3 to 4.5 centimeters in diameter. The gills are nearly crowded, free from the stem to curving out before reaching the stem, pale, then rust-colored. The stem is stuffed, rounded, nearly equal, white above, darker below, approaching the color of the cap, powdery, somewhat enlarged at the base. The spores in mass are rust-yellow. The flesh is white, odorless, and tasteless. This mushroom is terrestrial in habit and is found from May to December.

Genus PLUTEULUS Fries

The spores in mass are rusty yellow. The gills are free, not dissolving in wet weather. The stem is slender, distinct, nearly cartilaginous. The cap is putrescent, thin, sticky when wet. Veil, ring, and volva are absent.

PLUTEULUS COPROPHILUS Peck. Plate 46, fig. 1.

This mushroom grows in tufts, like grass, or in company but not joined, on decaying straw piles, on composite heaps, or on

⁴⁷ Rusty mushroom.

dung, especially on lawns, fields, and under trees where manure has been thrown. It can be found from May to November.

The cap is broad, fragile, at first conical then expanded, depressed on the disc, viscid when moist, marked with fine lines on the margin, whitish, later rosy gray or pinkish light brown, 3 to 6 centimeters in diameter. The gills are free, narrow, crowded, pale, rusty light brown, dotted by the rust-colored spores. The stem is straight or bending near the base, slender, hollow, pure white, rarely tinged with pink, smooth or rather beset with small scales, equal or tapering upward, 6 to 12 centimeters long, 2 to 5 millimeters in diameter. The flesh is thin, semitransparent. The spores in mass are rust-colored.

Genus PHOLIOTA Fries

The generic name is taken from the Greek word *pholio*, meaning "scale," and refers to the scaly character of the cap in many of the species.

The genus *Pholiota* is similar to *Armillaria* in structure, except that the spores are yellow. The species of the genus *Armillaria* have white spores. The members of the genus *Pholiota* grow on wood or on the ground. The cap is fleshy, and may be slippery, wet, dry, scaly, or naked. The ring is present, persistent, membranous. The gills are usually broadly attached to the stem, or decurrent, sometimes just reaching the stem, dull yellowish brown at first, becoming dark brown.

PHOLIOTA AURIVELLA Fries. Plate 46, fig. 2.

A beautiful mushroom that grows on the ground, either solitary or in groups of several. This plant is found from July to September, under trees near the forest.

The cap is 5 to 10 centimeters in diameter, bell-shaped in youth, becoming convex-plane in age, covered with woolyarnlike fibers of orange yellow to pinkish yellow; the rest is white, the margin near the gills is still bearing remnants of the veil even when it is already opened. The flesh is white. The stem is cylindrical, solid, stuffed, of the same color as the cap, 4 to 7 centimeters long, 6 to 8 millimeters in diameter. The ring is present, woolly, evanescent. The gills are free, close, numerous, white in the button stage, becoming pink and finally dark yellowish brown at maturity. The spores in mass are rust-brown.

THE PURPLE-BROWN-SPORED AGARICS

The members of this subdivision are characterized at maturity by the spores in mass appearing purple-brown, dark brown, or

nearly black. The ripened spores on the gills give the characteristic color to the latter. Many members of this group are economically important, like the species of the genus *Psalliota*, many of which are considered among the most delicious mushrooms there are in the market.

Genus PSALLIOTA Fries

The cap is fleshy. The stem is fibrous, fleshy, easily separated from the cap. The ring is present on the stem, disappearing in some species. The gills are free, whitish at first, then frequently pink and at length deep purple-brown. All the species are terrestrial. The spores at maturity are either purple-brown or blackish, with a purple tinge when collected in mass.

All the species of this genus are edible. A large number of them are found in the Philippines, yet very few have been identified and studied.

It is always best to cook these mushrooms in the button stage, when they are mellow and tender and do not darken the soup. In youth the spores are white, becoming pink-brown on maturity.

PSALLIOTA ARGYROSTICTA Copeland. Plate 47, fig. 1.

The cap is at first conical, later convex-plane, shiny white, always naked, somewhat fleshy, with unchanging gray flesh, 2.5 to 4 centimeters in diameter. The gills are free, almost round at both ends, 3 millimeters deep, gray at first, later dark. The stem is 3 to 4.5 centimeters long, 3 to 5 millimeters in diameter, strongly attached to the cap, gradually tapering upward, solid or nearly so. The ring is membranous, lasting but a short time. The flesh is odorless, with an agreeable taste. The spores in mass are pink-brown.

This mushroom is edible. It can be found in grassy places under trees, from June to September.

PSALLIOTA CAMPESTRIS Fries. Kabuteng parang na puti (Tag.). Edible. Plate 48, fig. 1.

The specific name *campestris* is derived from the Latin word *campester*, meaning "belonging to a plain."

This delicious mushroom is quite scarce in the Philippines, although if it is found at all it is found in large numbers. It grows on the ground, in grassy places in the open field, sometimes under trees, and appears from about May to September.

This mushroom is at first white and smooth, later covered with some brown rough scales. The cap is half-round to bell-

shaped, 3 to 6 centimeters in diameter, quite thick and fleshy. The gills are free, in youth pink, covering the veil, slowly becoming pinkish brown upon maturity. The veil becomes the ring that is attached around the stem; a portion of the veil is left attached on the gills, just below the margin of the cap. The stem is stuffed, stout, cylindrical, with a little enlargement at the base.

This mushroom is canned, and is imported from Europe as "champignon," and from the United States as "mushroom."

PSALLIOTA CAMPESTRIS Linnaeus var. *EDULIS* Vittadini. Kabuteng parang⁴⁸ (Tag.). Edible. Plate 48, fig. 2.

This mushroom has excellent eating qualities. It is found from June to about November.

The cap is 4 to 6.5 centimeters in diameter, at first somewhat globular, then round-convex, finally expanded and nearly flat; the surface at first is nearly smooth, with a soft silky appearance, due to the numerous loose fibers, more or less scaly in age, white to creamy white or light brown; the margin of the cap extends somewhat beyond the ends of the gills. The flesh is white. The gills are free, close, rounded toward the stem, pink, becoming purple-brown as the spores mature, at first covered by the inner veil, later the veil is separated. The stem is white or whitish, nearly cylindrical or somewhat tapering toward the lower end, 3 to 6 centimeters long, 1 to 1.8 centimeters in diameter. The inner veil from which the ring is formed is silky, white, thin, very frail, a portion often being left at the margin of the cap; the ring formed from the veil on the stem is also very frail, evanescent. The volva is absent. The spores in mass are dark brown or nearly black, with a purplish tinge.

PSALLIOTA CAMPESTRIS Linnaeus var. *UMBRINA* Fries. Oong ya balit⁴⁹ (Pang.). Edible. Plate 49, fig. 1.

The cap is 5 to 12 centimeters in diameter, compact, fleshy, convex to nearly half-round, becoming umbonate when expanded, at first covered with a thin layer of fine fiber, at length torn into a fringed sharp-pointed scalelike form. The gills are very crowded, free, white, pale yellow to flesh-colored, later tobacco-colored to dark, round at the back. The stem is 3 to 6 centimeters long, 1 to 2.5 centimeters in diameter, stuffed with cottony materials, later becoming slightly hollow, nearly equal, sometimes tapering toward the apex; below the ring the color is

⁴⁸ Mushroom in the open plain.

⁴⁹ Mushroom with stripes.

similar to that of the cap, sometimes a little paler, and covered with fine fibrils, at length becoming smooth; the upper portion is white to nearly tile-colored, somewhat powdery on the surface. The ring is white on the upper part, brown below, broad, more or less permanent. The flesh is white, pale yellow to dilute brick red. It has a pleasant odor and an agreeable taste.

This mushroom is one of the most delicious, growing on the ground from May to September. It is often seen under acacia trees.

PSALLIOTA COMTULA Fries. *Payungpayunggan malagu* (Pam.). Edible. Plate 49, fig. 2.

The cap is fleshy, convex, flattened, silky to smooth on the surface, white to clay-colored. The center is somewhat purple to pale brown, 2 to 4 centimeters in diameter. The gills are crowded, swollen, round and free, white, flesh-colored to very pale brick-colored, with white edges. The stem is stuffed, cylindrical, generally thickening towards the base, covered with a thin layer of very fine fibrils, 3 to 5 centimeters long, 2.5 to 5 millimeters in diameter. The ring is medium in size, bent upward, thin, white, lasting but a short time. The flesh is spongy, smooth, juicy, grayish white, with pleasant odor and taste.

This mushroom grows on grassy places, often under bananas, from June to September. It is edible.

PSALLIOTA LUZONIENSIS Graff. *Kabuteng parang na maitim-itim* (Tag.). Edible. Plate 50, fig. 1.

This terrestrial mushroom is often found solitary, and sometimes in groups of few. It is edible and has a slight earthy odor. The Tagalog name has reference to the color and place where it is found—*maitim*, meaning "dark," and *parang*, "plain."

The cap is fleshy, convex to expanded, clothed completely with delicate red-brown fibers, except for the central portion which is solid brown, soft, smooth, with a very thin margin, 7 to 8.5 centimeters in diameter. The margin occasionally shows remnants of the membranous veil. The flesh is white and thin. The gills are free, fine, crowded, at first white, soon assuming the color of the cap. The stem is 6 to 12 centimeters long, 6 to 8 millimeters in diameter, somewhat slender, solid, fibrous throughout, white to light brown, smooth except above the annulus where it is slightly finely woolly. The ring is membranous, persistent to evanescent, well up on the stem. The spores in mass are dark purple brown.

°° Beautiful mushroom.

PSALLIOTA MERRILLII Copeland. Kabuteng parang na bulik⁵¹ (Tag.). Plate 47, fig. 2.

A rather large mushroom, growing in open plains from June to November. It is found in group of few, sometimes single. It is edible but not as palatable when cooked as *Psalliota campestris* or *Psalliota perfuscus*. This species was first found and described by Dr. E. B. Copeland, former Dean of the College of Agriculture, University of the Philippines, and the specific name was given it in honor of Dr. E. D. Merrill, former Director of the Bureau of Science.

The cap is scaly, sometimes naked, white, becoming brown, shiny, nearly fleshy, cut off or round at the top when young, 8 to 12 centimeters in diameter. The stem is whitish, turning brown, stout, abruptly enlarged at the base, somewhat contracted at the top, 9 to 11 centimeters long, 7 to 10 millimeters in diameter. The ring is high up on the stem, white on both sides, very torn and often hanging. The gills are free, crowded, somewhat sharp at the edge, at first salmon-colored, finally turning black. The spores in mass are dark brown or nearly black, with purplish tinge.

PSALLIOTA PERFUSCUS Copeland. Kabuteng parang na may singsing⁵² (Tag.). Edible. Plate 50, fig. 2.

Unfortunately this very delicious mushroom is not known by the people. It is found in great abundance in grassy places, in lawns, on polo fields, and on golf links. The writer has collected this mushroom very regularly for the kitchen during the mushroom season. It is as delicious as the common *Psalliota campestris*. It is best cooked in the button stage, for then the soup is not colored by the white spores as it is by the brown spores when the mushroom is mature. People should be encouraged to utilize this delicious food which otherwise goes to waste every year. It is found from June to about September, but is most abundant during June and July. This plant frequently forms a fairy ring (Plate 5).

In youth the whole plant is snow white. The cap is early expanding, scaly, depressed at the center, 3 to 5 centimeters in diameter; the margin is wavy, often torn. The gills are free, close, blunt on both ends. The stem is firm, smooth, nearly hollow, 3 to 4 centimeters long and 3 to 5 millimeters in diam-

⁵¹ Spotted mushroom in the open plain.

⁵² Mushroom in the open plain with a ring.

eter. The ring lasts but a short time and is located well up on the stem. The spores in mass are dark brown, with a purplish tinge.

Genus STROPHARIA Fries

The characters of the members of this genus resemble those of *Armillaria* and *Pholiota*, except in their having purple spores. The cap is sometimes provided with a delicate superficial membrane and may be scaly and slippery or dry, with fine hair. The stem is fleshy and provided with a ring. The ring may be membranous, or fibrous to cottony. The gills are more or less brownish.

Most of the species grow on wood, but a few grow on the ground.

STROPHARIA SEMIGLOBATA Fries. Kabuteng kalabau na may singsing⁵³ (Tag.). Not tested. Plate 51, fig. 1.

This is a common and widely distributed mushroom, growing on animal dung and on richly manured ground, in pastures and other grassy places, from June to October.

The cap is yellow, fleshy, hemispherical, smooth, erect, shining when dry, 1 to 5 centimeters in diameter. The stem is yellow, paler above, darker below, equal, hollow, tense and straight, smooth, smeared with the glutinous veil, 3 to 11 centimeters long. The ring is wet, thin, incomplete, distant above the middle of the stem. The gills are pale purplish, attached squarely against the stem, very broad and plane, clouded with purple patches of adhering spores. The spores are blackish purple. The flesh is pallid.

The edibility of this mushroom has not yet been tested. In America, however, it is considered edible.

THE BLACK-SPORED AGARICS

The members of this group have black spores in mass. Many of the species are edible, although they are small. All except a few species grow on the ground, on livestock dung, or on richly manured soil. They are very resistant to drought, being the first mushrooms found in the season.

Genus COPELANDIA (Bulliard) Bresadola

The cap is fleshy, bell-shaped. The gills are nearly swollen, broadly attached, sometimes decurrent, covered with small wart-

⁵³ Mushroom on carabao manure with a ring.

like protuberances. The stem is at the center, hollow, slender. The veil is evanescent. The spores in mass are black.

The species of this genus are dung dwellers, sometimes found on heavily manured ground. They decay easily.

This genus was erected in honor of Dr. E. B. Copeland.

COPELANDIA PAPILONACEA (Bulliard) Bresadola. Kabuteng taing kalabau⁶⁴ (Tag.).
Not tested. Plate 51, fig. 2.

The plant is very common in the field, generally in pastures, and can be found from May to as late as February.

The cap is fleshy, somewhat hemispherical, smooth, whitish to gray-white, sometimes nearly pale yellow, cracking on the surface when dry and becoming scaly, 1.4 to 3 centimeters in diameter. The gills are loose, crowded to somewhat distant, swollen, just reaching the stem, dark gray, blotted with black dots. The stem is stuffed, cylindrical, equal, smooth, somewhat similar in color to the cap, darkening toward the base, mealy on top and smooth below, 4 to 12 centimeters long, 3 to 4 millimeters in diameter. The veil is pale and evanescent. The flesh is grayish white.

Genus **COPRINUS** Persoon

The name *Coprinus* is derived from the Greek word *kopros*, meaning "dung," and was given this genus because of its usual habitat.

The members of this genus are recognized by the black spores, and by the gills that dissolve at maturity into black or inky fluid. The cap is fleshy or membranous, at first cylindrical or egg-shaped, usually scaly, with the margin originally straight and pressed closely against the gills. The stem sometimes has a ring. The gills are free, broadly attached to the stem, or attached to a collar. They are very thin and parallel-sided, at first white, then becoming dark. The spores are black, violet-black, chocolate, or dark brown. The species grow in tufts or solitary, on the ground, or dung, or on rotten wood.

COPRINUS COMATUS Fries. Kabuteng kampanilla⁶⁵ (Tag.). Edible. Plate 52, fig. 1.

This is an early mushroom in the season, appearing from May to December. It grows on decayed vegetable matter, especially on decayed leaves and wood, in cool damp places in the forests. It is found singly or in groups.

The cap is slender, fleshy, somewhat silky, at first almost round, bell-shaped, later expanded, 3 to 6 centimeters in diameter. The apex is nearly smooth, dirty white, with the margin

⁶⁴ Mushroom on carabao dung.

⁶⁵ Bell-shaped mushroom.

often approaching rosy lilac, soon becoming black. The gills are very crowded, linear, silky fibrous, with the base often swollen. The stem is 10 to 15 centimeters long, 0.7 to 1.2 centimeters in diameter. The ring is membranous, very movable, evanescent. The flesh is white, smooth, watery, without odor or taste.

COPRINUS CONFERTUS Copeland. *Kabuteng taing kabayo*⁶⁶ (Tag.). Edible. Plate 52, fig. 2.

The cap is 3 to 6 centimeters in diameter, fleshy, at first conical, later, when expanded, depressed, grayish black, with a structural line and a yellowish brown or straw-colored disc, and covered with whitish cottony flakes. The margin is entire or cleft in a few places, becoming torn in age. During dry weather the cap is thick. In rainy days, however, it is very thin, clothed with a silky evanescent net. The stem is white, smooth, hollow, 12 to 15 centimeters long, and 7 to 13 millimeters in diameter, slightly swollen at the base. The gills are grayish black, free from the stem, crowded, lance-shaped. The spores in mass are black.

COPRINUS PLICATILIS Curtis. *Kabuteng may pliegues*⁶⁷ (Tag.). Edible. Plate 53, fig. 1.

This mushroom grows on horse dung and heavily manured ground in pastures. It is found from May to November.

The cap is membranous, plicate, dark brown, bluish gray to ashen, 2.5 to 5 centimeters in diameter, at first egg-shaped to bell-shaped, then expanded, at length depressed at the center. The stem is hollow, slender, cylindrical, rarely crooked, the base somewhat swollen, white, somewhat silky, shiny, 6 to 9 centimeters long, 2 to 4 millimeters in diameter. The gills are somewhat distant, linear, free, white to gray black. The flesh is very thin, white, odorless.

Genus *PANÆOLUS* Fries

Panæolus, a Greek word meaning "all variegated," was given as a name to this genus because the gills of its members have patches of different color.

The cap of the species of this genus is fleshy, conical, not expanded, viscid when wet, shiny when dry, with the margin exceeding the gills in length. The stem is usually smooth, cottony, scaly, often long, firm, generally hollow. The veil generally consists of interwoven threads, sometimes quite compact, especially when the plants are young. The gills are broadly attached to the stem or just reach the stem, and are marked with

⁶⁶ Mushroom on horse manure.

⁶⁷ Plicated mushroom.

different colors due to the sticking spores. These mushrooms grow in richly manured grassy places and on livestock dung.

Several species of *Panæolus* are known to be poisonous, so that care should be taken in collecting for the table. The effect of poisoning from *Panæolus* takes place soon, about fifteen or twenty minutes after the mushrooms are eaten. The symptom consists in general weakness of the body, sometimes affecting the sight. The effects of the intoxication are said to pass off within four hours. As soon as the effect of poisoning is felt, emetics should be administered to the patient to prevent the complete absorption of the poison in the body.

PANÆOLUS CAMPANULATUS Linnæus. Kabuteng kampana⁶⁸ (Tag.). Not tested.
Plate 53, fig. 2.

A very common mushroom, growing on animal dung, especially on that of horses, carabaos, and cattle, or on grassy places in heavily manured grounds. It sometimes grows singly, but mostly in groups of several to many. It is found from the latter part of May or June to November.

The cap is 2.5 to 4.5 centimeters in diameter, fleshy, conical to bell-shaped, sometimes umbonate, not fully expanded, smooth, white, somewhat shiny, not translucent, gray, clay-colored, becoming reddish, when dry wrinkled or cracking, then scaly; the margin is occasionally fringed with the remains of the veil. The gills are ascending to follow the conical shape of the expanded cap, loose, somewhat crowded, attached to the stem, gray-olive, sooty, black-spotted. The stem is 5 to 14 centimeters long, 3 to 5 millimeters in diameter, pithy, stuffed, cylindrical, sometimes channeled, frail, almost equal, a little broader at the base, of the same color as the cap, first white then black and powdery. The flesh is grayish, colorless, and tasteless.

Genus PSATHYRELLA Fries

The generic name *Psathyrella* is a diminutive taken from *Psathyra* which was derived from the Greek word *psathuros*, meaning "friable." This name has reference to the character of the cap of the members of these two genera to crumble into pieces.

The cap of the species of this genus is membranous, thin, and grooved. The margin does not extend beyond the edge of the gills, in youth lying straight against the stem. The gills are free or broadly attached to the stem, uniform, black. The spores are black.

⁶⁸ Bell-shaped mushroom.

The genus resembles the purple-brown agaric *Psathyra*, but is much thinner. The species grow on rich ground, sometimes on very much deteriorated wood.

PSATHYRELLA DISSEMINATA Fries. *Kabuteng malantahin*⁶⁹ (Tag.). Edible. Plate 53, fig. 3.

This is a very common and widely distributed species in the Philippines, occurring from June to November in rich soil or on decaying wood. The cap is fleshy, whitish or yellowish, becoming gray, or wood-ashy in color, scurfy, then smooth, deeply marked with grooves, 1.5 to 3 centimeters in diameter. The stem is fragile, often curved, slightly scurfy, then smooth, 3 to 6 centimeters long, 1.5 to 3 millimeters in diameter. The gills are whitish, then blackish, broadly attached to the stem. The plants are crowded in large tufts, often growing on decaying wood, but may also be found on the ground, especially about decaying stumps, in lawns, and similar places where decaying roots are buried. The spores in mass are black. The odor approaches that of rotten wood, but the taste is agreeable.

POLYPORACEÆ

The hymenium (the spore-bearing surface) in the members of this family lines the surface of the tubes, pores, or network. These mushrooms are usually round or angular, sometimes wavy or torn. They may be fleshy, leathery, or woody. The stem is central or eccentric. Sometimes the fruiting body is sessile, that is, without a stem, or the hymenium is inverted in position. In these forms the hymenium is superior, and in the other forms, inferior.

Many members of this family are soft, and no doubt a number of them are edible; others are hard and inedible. Many of them are very destructive to trees, causing decay. A good many are called "shelf fungi" because of the position in which they are attached on the host. This family differs from the Agaricaceæ in having tubes, pores, or reticulations instead of gills.

Genus BOLETUS Dillenius

The generic name is derived from the Greek word *bolos*, which means "clod;" in the members of this genus the shape of the cap is like that of a lump of earth.

In general appearance *Boletus* resembles the agarics, except that it has pores instead of gills. Many of the species of this

⁶⁹ Mushroom that wilts easily.

genus are found in the Philippines. They are generally abundant in the cooler mountain regions, although several are found in lowlands in places where the soil is largely composed of decayed wood and leaves. No doubt many of them are edible, and nothing has been so far heard of mushroom poisoning caused by any species of this genus. It would be of great interest and of much economic value to try the edibility of these mushrooms. In some countries outside the Philippines many of the boleti are considered a delicacy. In Baguio, Mountain Province, many members of this genus abound.

The entire plant is soft and fleshy and decays soon after reaching maturity. The stratum of tubes on the under side of the cup is easily peeled off. All the species grow on the ground. Some change color when bruised or cut. It is important to note this character as well as the taste when the plant is fresh, for the identification of the species.

BOLETUS BADIUS Fries. Kabuteng ahas⁶⁰ (Tag.). Not tested. Plate 54, fig. 1.

A common mushroom found everywhere in the lowlands and in the mountains. It grows on rotten leaves and wood, often on decayed sawdust under acacia trees. The mushroom can be found from June to October. The people consider it poisonous.

The cap is dark brown or olive-brown, with a slight green shimmer, 10 to 20 centimeters in diameter, hemispherical when young, then convex, plane, smooth, thin along the margin, sticky in damp weather; the surface cracks easily. The tubes are numerous and the pores distinct, sulphur yellow, adhering together. The stem is stout, cylindrical, stuffed, and soft, 7 to 12 centimeters long, 7 to 13 millimeters in diameter, of the same color as the cap. The flesh is cream-colored, turning blue when cut. This mushroom is not deeply rooted in the ground, and the roots are numerous but rather fine.

BOLETUS CASTANEUS Bulliard. Kabuteng mukang tinigkal (Tag.). Note tested. Plate 55.

This mushroom is generally found in the mountains where the temperature is cool and the air moist, appearing from June to about October. It is quite common in the mountainous towns of Cavite, although more abundant around Baguio, Mountain Province. This mushroom is considered edible in other countries. Its edibility in the Philippines, however, has not yet been tested. The Tagalog name has reference to the shape of the cap, which appears like a clod of soil.

⁶⁰ Snake mushroom.

The cap is convex to expanded, then becoming flattened to nearly depressed at the top, firm, pale brown to dark brown, 4 to 9 centimeters in diameter. The tubes are crowded, white to pale sulphur. The pores are round, adhering to one another, white and hardly noticeable in youth, later becoming wide and lemon-yellow. The stem is firm, cylindrical, swollen at the base, often slightly furrowed, of the same color as the cap, loosely stuffed, 4 to 8 centimeters long, 1 to 1.8 centimeters in diameter. The flesh is white, becoming pinkish red when opened, with an agreeable odor.

BOLETUS EDULIS Bulliard. Edible. Plate 54, fig. 2.

The cap is strongly convex, smooth, not sticky, usually brownish to chesnut-brown, sometimes gray, becoming reddish, 5 to 15 centimeters or more broad. The tubes are short, narrow, round, nearly free, yellow, later becoming green. The pores are very small, round, of the same color as the tubes. The stem is more or less stout, sometimes slender, cylindrical, rarely bulbous at the base, for the most part equal, at times tapering, of the same color as the cap, 5 to 12 centimeters long, 2 to 4 centimeters in diameter. The flesh is white, becoming reddish when peeled off, compact, smooth, with a pleasant odor and taste.

This mushroom grows on the ground and is quite common in Baguio, Mountain Province.

Genus *DAEDALEA* Persoon

This genus resembles *Trametes*, except in the firmer, thick dividing walls of the pores, which, when fully developed, are irregularly wavy or complicated in form, often becoming torn or toothed.

The members of this genus occur in woods, on stumps, and trunks. They cause rot by penetrating the tissues of the wood.

DAEDALEA FLAVIDA Lévêille. Kabuteng kapis⁶¹ (Tag.). Not edible. Plate 56, fig. 1.

A wood-inhabiting mushroom, causing rot on trees. It is very common in the Philippines. Its hard texture renders it unfit for food.

The cap is leathery to corky, hemispherical, naked, furrowed, light yellow; the margin is nearly sharp. The stem is lateral, often very short or absent. The pores are large, at first rounded, becoming much contorted, elongated, deep, wavy, pale

⁶¹ Shell mushroom.

yellow. The thick flexible walls or partitions resemble gills, and are pale yellow, obtuse, and somewhat hairy.

This mushroom is 5 to 30 centimeters in diameter, and 3 to 21 centimeters high, and its stem is 6 to 12 millimeters in diameter. It is found all year around.

Genus GANODERMA Karsten

The members of this genus are quite numerous in the Philippines. They grow on trunks of trees, causing wood rot. They are among the most common wood-destroying fungi in the Philippines. Many of the species attain extraordinary size.

The cap is somewhat beaked and shelflike when attached to the tree, covered with a hard shiny coating. The members of this genus are sessile, but sometimes a short stalk is present. The tissue is for the most part brown. The tubes are rarely single but composed of many layers.

None of the species are edible.

GANODERMA MANGIFERÆ Lévillé. Kabuteng punong manga⁶² (Tag.). Not edible. Plate 56, fig. 2.

The cap is 8 to 15 centimeters in diameter, 1 to 2 centimeters thick, corky to woody, sessile, hemispherical to broadly lengthened; one side shiny, appearing varnished, marked with furrows that have a common center, the other side smooth yellow; the margin is openly blunt, sterile. The pores are tiny, angular, dull, yellowish white.

This mushroom is found all year round. It is too hard to be edible.

Genus HEXAGONA Fries

The Latin generic name refers to the shape of the pores.

The members of this genus are abundant in the Philippines. They are easily recognized by their shelflike attachment on the host and the honeycomb formation of the pores. They are sessile, somewhat corky to woody, persistent, and reviving. The flesh is not formed in layers. The pores are regular and firm.

HEXAGONA APIARIA Persoon. Kabuteng hugis bahay bubuyog⁶³ (Tag.). Not edible. Plate 57, fig. 1.

The cap is nearly corky, kidney-shaped, a little hollow, thin, 6 to 10 centimeters in diameter, 5 to 10 millimeters thick, generally smooth, but sometimes the surface is densely shielded with coarse, dark hairs which are movable on old specimens. The pores are wide, regular, usually greenish blue, covered with

⁶² Mushroom on mango tree. ⁶³ Mushroom resembling the beehive.

tiny trichomes (very fine sharp hairs) that are hardly visible to the naked eye.

This mushroom is attached to the host in a shelflike manner. It can be found all year round, but is more developed during the rainy season.

Genus POLYPORUS (Micheli) Fries

The generic name *Polyporus* was derived from the Greek words *polus* and *poros*—the former meaning “many” and the latter, “pore.” The species of this genus are characterized by the presence of many pores.

The members of this genus are annual or perennial, usually growing on wood, causing destruction of their hosts. Many of them are found in the Philippines. The cap is woody to corky, or nearly soft. The stem is central, lateral or absent, and may be either single or branched. The pores are round or angular, entire, torn, or toothed.

POLYPORUS SANGUINEUS Linnæus. Kabuteng mapula⁶⁶ (Tag.). Not edible. Plate 57, fig. 2.

This is a beautiful blood-red mushroom growing all year round, on rotten wood, generally in the forests. It is found in groups of many. It is tough but not poisonous.

The mushroom is somewhat kidney-shaped to shell-shaped, shiny, with furrows that have a common center. It is 3 to 12 centimeters in diameter, porous, and the pores are barely visible to the naked eye. Sometimes they are very conspicuous near the center, disappearing toward the margin. The stem is only 4 to 6 millimeters long. Sometimes it is absent.

POLYPORUS SULPHUREUS Fries. Edible. Plate 58, fig. 2.

The specific name *sulphureus* is a Latin word, meaning “sulphurlike.” This mushroom is a wound parasite. It starts to grow on wounds or dead branches, thence gaining entrance to the heartwood of the main stem, where it causes the characteristic heart rot. It can be found from May to November.

The cap is reddish yellow or orange, becoming paler with age, powdery, imbricated, sessile, sometimes with a very short stalk. The flesh is light yellowish, then white, often exuding a sulphur-yellow liquid when broken, with a typical mushroom odor and a bitter taste. The mass is 9 to 25 centimeters in diameter.

⁶⁶ Red mushroom.

Genus FOMES Karsten

Fomes is a Latin word meaning "touch-wood tinder"—indicating that probably many species of this genus were used as tinder in the old days in some countries.

The cap at first is woody, hardened, rarely soft. The substance is interwoven, woolly, covered with a rigid hardened exterior coating, without any encircling bond, but at length deeply furrowed concentrically. The species are perennial and grow on wood. Many of them are found in the Philippines.

FOMES PACHYPHLOEUS Patouillard. Not edible. Plate 58, fig. 1.

A very common, large mushroom, growing on dead trunks of trees and sometimes on living trunks, attaching itself in a bracketlike formation. This mushroom sends out mycelial bodies through the wood and causes serious rotting. Because of its toughness the Igorots grind this mushroom before cooking. It is palatable when cooked, but too hard to call edible.

The cap is broad, ranging from 15 centimeters to an enormous diameter, toward the front is carried out into a cushionlike form. The flesh is corky-woody, rust-colored, becoming chocolate-brown to dark brown in age, sometimes smooth but generally roughened by the furrowed spaces along the margin; these furrows have a common center; the cuticle is thick and soon cracks. The tubes are not very distinct, rust-colored to brick-colored, 1.5 to 3 centimeters long; the pores are minute, nearly round, pale yellow to rust-colored.

This mushroom is found all year round. Its favorite host is the bagtikan tree.

Genus TRAMETES Fries

Several species of this genus are found in the Philippines. They grow on wood in a more or less overlapping formation, resembling that of a tiled roof. They are annual or perennial. The cap is woody or corky, shelflike or twisted, sessile. The tubes do not form a distinct layer and the pores are somewhat spherical, more or less elongated radially, entire, often unequal in depth, and provided with a thick dividing wall.

TRAMETES ASPERA Junghuhn. Kabuteng hugis abaniko⁶⁵ (Tag.). Not edible. Plate 58, fig. 3.

A common white bracket mushroom growing all year round on dead wood. It is a wood-destroying fungus, considered too tough to be edible.

⁶⁵ Fanlike mushroom.

The surface of this fungus is very rough to the touch because of the fine long fibers that are lying flat on the surface. The cap is 6 to 14 centimeters in diameter, concentrically zoned, white, sometimes greenish, becoming grayish in age. The pores are about 7 millimeters deep, radially elongated, pale tan. The flesh is whitish, compact, thick, very firm and corky.

HYDNACEÆ

The plants belonging to this family vary greatly in size, consistency, and form. Some of them are very large. They are either fleshy, woody, corky, or membranous. Their outstanding character is that of the fruiting surface, which covers the body in numerous processes, either in the form of spines, teeth, warts, coarse granules, or folds. These features are always directed toward the earth. Many of the Hydnaceæ are shelf-like in form. They grow on trees or on the ground. They often have a central or eccentric stem, with a more or less circular cap. Some of them are more or less rounded masses, which grow from trees with very long spines that extend downward. Others have ascending branches from which the spines depend; still others form sheets, spreading over the surface of logs and sticks.

Genus HYDNUM Linnaeus

In this genus the fruiting surface is awl-shaped or in the form of spines. It is either simple or with the tips more or less branched. The plants grow on the ground or on wood. The spines vary greatly in form; some are provided with a more or less regular cap and a stem, others are shelving or bracket-shaped, and the rest are just spreading out over the surface of the wood.

HYDNUM ERINACEUS Bulliard. *Kabuteng may mahabang balahibo* ⁶⁶ (Tag.). Edible. Plate 59, fig. 1.

This is one of the most beautiful mushrooms, growing on rotten logs in cool, damp places in the forests. It is edible, but rather rare.

This mushroom is yellowish white, 10 to 20 centimeters broad above the fiberlike spines, fleshy, somewhat flexible, roughened, and nearly sponge-shaped. At the end it is tapering, appearing somewhat stalked, and more or less rooted. The tip is acute, 2 to 6 centimeters long, and 2 to 5 millimeters wide at the end.

⁶⁶ Mushroom with long hair.

In age, this fungus becomes cream-colored to yellowish tawny. The flesh is white, tenacious, and hollow. It has a strong mushroom odor.

HYDNUM VELUTINUM Fries. Not tested. Plate 59, fig. 2.

The cap is nearly even, leathery, convex, often depressed at the center, hairy, without zones, yellow or rust to nearly brick-colored, 5 to 7 centimeters in diameter. The spines are decurrent, dark brown, becoming pink at the end, 4 to 6 millimeters long. The stem is short, enlarged at the base, hairy, 2.5 to 4 centimeters long, 1 to 14 millimeters in diameter at the apex, 1.2 to 2 centimeters at the base, sometimes more or less rooted, of the same color as the cap. The flesh on the stem and the underside of the cap is somewhat leathery, soft on the upper portion of the cap.

This is not a common mushroom in the Philippines, and its edibility has not yet been tested. It grows on old stumps and prostrate trunks and can be found in moist cool places in the mountains.

CLAVARIACEÆ

THE CORAL FUNGI

The Clavariaceæ are characterized by a spore-bearing surface which may cover more or less the entire spore-bearing body. Many members of this family are fleshy. They are often much branched, or corallike. Some are club-shaped. All species that are sufficiently fleshy or delicate are edible. All of the branched forms are good to eat. Many members of this family are brightly colored and very beautiful.

Genus *CLAVARIA* Bulliard

The generic name is taken from the Latin word *clava*, meaning "club," in reference to the shape of many of the members of this genus.

This is economically the most important genus of the family, for it includes numerous edible species. The fruiting body is erect and fleshy, or somewhat leathery. It is either branched, simple, or club-shaped. The hymenium is even and borne on both sides, but absent from the stemlike portion of the simple club. Most of the members of this genus grow on the ground.

CLAVARIA CRISPA Wulfen. Oong n̄ga repollo⁶⁷ (Ilk.). Edible. Plate 60, fig. 1.

This mushroom resembles a cabbage. It is whitish or pale yellow, and very much branched. The branches are ribbon-

⁶⁷ Cabbage mushroom.

like, broad, entangled, 2.4 to 4 centimeters wide; the apex is tinged yellowish, crisped, slightly zoned. The stem is whitish, becoming blackish with age, stout, and rooting. The flesh is whitish or yellowish, fleshy, and brittle. The whole plant is 8 to 58 centimeters in diameter.

This mushroom is edible. It has a pleasant smell and agreeable taste. It is quite common in Baguio, Mountain Province, growing on the ground under pine trees.

CLAVARIA STRICTA Persoon. Kabuteng bulaklak nang bato (Tag.). Edible. Plate 61, fig. 1.

This mushroom is found growing in most places, including the city of Manila, on trunks and roots of trees, especially on acacia trees. It can be found from June to September.

The plant is from 6 to 11 centimeters high and 10 to 15 centimeters broad, consisting of a mass of crowded branches in an upward position. These branch several times and form pointed teeth at the end. The color is white to creamy.

This mushroom is edible. It has a corallike form, hence its Tagalog name.

CLAVARIA ZIPPELII Léveillé. Kabuteng may sañga-sañga⁶⁸ (Tag.). Note tested. Plate 60, fig. 2.

A treelike mushroom, growing on the ground in damp places, generally in the forest. It has many branches. It can be found from June to September.

The trunk is 6 to 11 millimeters in diameter. The branches are generally in pairs, indented at the base, 3 to 6 millimeters in diameter, 5 to 10 centimeters long; at the end of each branch are long needlelike points resembling the leaves of pine trees, 1 to 2 millimeters wide, 2 to 4 centimeters long. The whole plant is 15 to 20 centimeters high, yellow, darkening in age.

TREMELLACEÆ

The members of this family are more or less gelatinous in consistency. They are covered on the surface by the whole fruiting layer. Sometimes this layer is confined to only one side. When dry the plants are rigid and horny, regaining their original form when moistened or soaked in water. They grow on rotting wood, such as prostrate trunks and branches of trees, varying in color from gray, yellow-orange, and reddish, to brownish. They assume various forms, are often very irregular, leaflike, or strongly folded and uneven.

⁶⁸ Many-branched mushroom.

Genus AURICULARIA Bulliard

The generic name *Auricularia* is derived from the Latin word *auricula*, meaning "ear"—the likeness of this mushroom.

The fruit body when moist is gelatinous to leathery, cartilaginous to horny when dry, cup-shaped, sometimes asymmetrical. The fruiting surface is smooth, decorated like a network or folded into plaits, and normally located on the lower side. The genus *Auricularia* is found generally throughout the Philippines, as well as the world over. It is commonly called *taingang-daga*, meaning "rat's ear," in Tagalog, and "Jew's ear" in American, while in Panay it is called *dolongan sang kahoy*, meaning "ear on the wood."

Species of *Auricularia*, generally the *Auricularia auricula-judæ*, are sold in the market. They are imported from China in a dried form. The *taingang-daga* is almost indispensable in many of the Chinese dishes in restaurants and chop-suey houses.

Although the native *Auricularia* is found in abundance in the Philippines, its commercial value is little appreciated in this country, where people prefer to buy these mushrooms imported instead of collecting them in the fresh condition.

With but slight variations, the edible members of *Auricularia* are distantly and vaguely ribbed and plicated, swollen, somewhat jellylike, and of a violet color when moist.

AURICULARIA AFFINIS Lévêille. *Taingang-daga* (Tag.); *dolongan sang kahoy* (Panay). Edible. Plate 61, fig. 2.

Auricularia affinis is rather common. Its eating qualities are as good as those of *A. polytricha* and *A. auricula-judæ*. It is thinner, however, not so cup-shaped, smoother, and lighter in color. Like the rest of the *taingang-daga*, this mushroom is found all the year round, growing on prostrate trunks and branches of trees, although it is more abundant during the rainy season.

This mushroom can also be dried. If it has been dried, soaking in water before cooking will make it soft and tender.

AURICULARIA AURICULA-JUDÆ (Linnaeus). *Dolongan sang kahoy* (Panay); *taingang-daga* (Tag.). Edible. Plate 62.

This fungus grows on stumps, fallen trunks, and dead branches of trees. In taste it does not differ much from the other members of *Auricularia*. Those imported from China are mainly *A. auricula-judæ*. In England this plant was formerly used as a remedy for dropsy and for sore throat. It is very popular in Chinese chop-suey houses, where it is hardly ever lacking in a

soup dish. This mushroom is found all year round, although it is most abundant from May to September. In the forests, where there are plenty of fallen trees, this species can be collected by the basketful.

The fruit body is grey, then olivaceous or reddish brown, finally dark brown, cup-shaped, half-round, concave, then ear-shaped, turning plicate, transparent, hairy. The flesh is whitish, gelatinous, then cartilaginous and tough. Soaked in water, it revives, assuming its original size and form.

AURICULARIA DELICATA Lloyd. *Taiñgang-daga* (Tag.); *dolongan sang kahoy* (Panay).
Edible. Plate 61, fig. 3.

This very common *Auricularia* grows on prostrate trunks and branches of trees, generally on the bagtikan. It can be found all year round in the forests, although it is more abundant during the rainy season. It does not grow to a large size, and is very much smaller than many of the *taiñgang-daga*. It is, however, thicker, paler, and more gelatinous than any of them. The main character that distinguishes this species from the rest is the prominent venation. It is from 4 to 8 centimeters in diameter. The stalks is very short and often wanting.

In edibility this mushroom is considered the best. When cooked, it is very tender. It can be easily dried and stored for future use.

AURICULARIA MESENERICA Persoon. *Taiñgang-daga na may balahibo*⁶⁶ (Tag.).
Edible. Plate 63, fig. 1.

Meso is a Greek word meaning "middle," *enteron*, "intestine;" this species is named then from a fancied resemblance to a mesenteric membrane.

This mushroom is found in the same abundance as *Auricularia auricula-judæ*. It grows on stumps, fallen trees, and old bamboos. It is edible but tough. When dried and soaked in water it revives. This species is found all year round, but in greatest abundance during the rainy season.

The fruit body is dark brown or tawny, often cup-shaped, then bent backward, overlapping like a tiled roof, entire or lobate, grouped in concentric formation. The hymenium is in upward position, pale or brownish, then brownish violet, wrinkled, powdery with the spores. Flesh dark brown, gelatinous, then cartilaginous.

⁶⁶ Hairy *Auricularia*.

AURICULARIA POLYTRICHA (Montagne) Saccardo. *Tain'gang-daga* (Tag.); *dolongan sang kahoy* (Iloilo Vis.). Edible. Plate 63, fig. 2.

This is another species very common in the Philippines, growing on dead trunks and dried branches of trees. *A. polytricha* assumes a large size, measuring from 6 to 14 centimeters in diameter. This mushroom is rather thin, gelatinous, becoming leathery when dry, having round projections at the margin, with or without a very short stalk.

This mushroom is edible, and can be collected in large quantities, especially during the rainy season. It can be dried and stored.

Order GASTEROMYCETES

The members of this order are distinguished from the other orders by the fruiting surface being enclosed within a membrane or *peridium* until the spores are mature. This peridium, or wall, consists of one to three layers. When more than one layer is present, the outer layer is called the *exoperidium*, the inner the *endoperidium*. The contents of the peridium are collectively known as *gleba*.

Family PHALLOIDEÆ Fries

A great majority of the stink-horn fungi are characterized by a very offensive odor. Some of them at maturity are shaped like a horn. They grow on the ground or on decaying organic matter. The spawn or mycelium is in the form of strands, which are usually much branched and matted together. From these cords the fruit form arises. The fruit body is at first enclosed in an oval or globose peridium commonly called the egg. The peridium ruptures at the apex, allowing the young plant to develop. The remaining peridium forms the volva. The *gleba*, which is a soiled mass of spores, is moist and sticky, and attached to a stem or trellised receptacle. The receptacle is hollow.

Among the stink horns are a number of interesting genera. Some of them are very beautiful, although they possess offensive odors. None of the members are edible.

Genus DICTYOPHORA Desvaux

This genus is given the name *Dictyophora*, meaning "net bearer," because of the net that is borne by its members.

The stem or receptacle possesses a very coarse mesh, so that not only the surface but also the substance within is reticulated, pitted, and irregularly perforated. In this genus an outer layer of the receptacle or stem separates and elongates, breaks

away from the lower part of the stem, is carried aloft, and hangs as a beautiful veil. This veil is very conspicuous in some species.

DICTYOPHORA DUPLICATA (Bosc) E. Fischer. Kabuteng may pandong (Tag.); óóng ti uleg (Ilk.). Poisonous. Plate 64, fig. 1.

This mushroom when young has the shape of a large egg, nearly round or sometimes flattened. It is 3.5 to 4.5 centimeters in diameter, white, and more or less furrowed below, like a peeled orange. The upper portion is smooth, flesh-colored to pale brown. The center of the base is provided with a large bunchy root. The whole plant when fully expanded is 15 to 18 centimeters high. The apical cap is 3 to 4 centimeters long and 3 to 4.5 centimeters in diameters, strongly chambered by anastomosing plates over which the olive-colored mass of spores is spread. Between the stem and the cap and hanging down from the top is a beautiful light rosy-pink veil. The veil extends below the cap for 3 to 5 centimeters. The stalk is 2.8 to 4 centimeters thick, nearly cylindrical, hollow, with chambered walls. It is provided with a volva at the base. The odor of the slimy spores is very offensive, and attracts flies.

This mushroom grows on the ground and can be found from May to September. It is poisonous.

DICTYOPHORA sp. Kabuteng may pandong (Tag.); óóng ti uleg⁷⁰ (Ilk.). Poisonous. Plate 64, fig. 2.

A beautiful mushroom growing in thickets, generally under wild bamboo trees. Like other phalloids, it takes the form of an egg when young. At first, it has a pleasant smell, but later it has a very offensive odor. It can be found from June to December.

This plant is from 10 to 14 centimeters tall. The cap is 4 to 6 centimeters long, 4 to 5.5 centimeters in diameter, conical, carved on the surface into a network and covered by the olive slimy mass of spores. The stalk is 2 to 4 centimeters wide, nearly cylindrical, hollow, with a corrugated surface. The Ilocano name has reference to the veil, which resembles the skin of the snake after molting. The Tagalog name refers to the veil borne by the fungus itself.

This mushroom is closely similar to *Dictyophora phalloidea* in many respects, except that it has the thread composing the veil much coarser than that in the latter, and in *Dictyophora*

⁷⁰ Snake mushroom.

phalloidea the veil is a continuation of the cap itself, while in *Dictyophora* sp., it starts under the cap.

DICTYOPHORA PHALLOIDEA Desvaux. Kabuteng may pandong (Tag.); Oóng ti uleg (Ilok.). Poisonous. Plate 65.

This is one of the largest and most beautiful phalloids in the Philippines, growing on the ground, especially under bamboo trees in the forest. When young or just opened it has a pleasant smell, but in age, as it begins to rot, it has a very bad odor, resembling that of a decomposing animal carcass. This mushroom grows from June to December.

This plant arises from a large egglike body. It is white and furrowed below, like a peeled orange. The upper part is smooth, pale to deep flesh-colored. On the center below is a large fleshy root with lateral branches. The size of the egg is 3 to 4.5 centimeters in diameter. The full-grown plant reaches the height of 15 centimeters. The cap is broadly bell-shaped, curved into a network on the surface, over which the brownish olive slime is spread. On top, at the apex of the cap, the color is much paler. The cap is 4 to 5 centimeters long and 3.5 to 4.5 centimeters broad. The rosy-pink-blue netlike veil is a continuation of the cap and often reaches the ground. The size of the meshes is 2 to 4 millimeters, except towards the margin, where they become much smaller. The stalk is 2.5 to 3.5 centimeters in diameter, nearly cylindrical, hollow, and with chambered walls.

Genus CLAUTRIAVIA Lloyd

This genus is characterized by having the surface of the cap convoluted into very fine folds. The mass of spores, called gleba, covers the fold and permeates the interspaces.

CLAUTRIAVIA MERULINA Lloyd [= **PHALLUS MERULINUS** Berkeley]. Kabuteng may pandong (Tag.); oóng ti uleg (Ilok.). Poisonous. Plate 66.

This species has the general appearance of a *Dictyophora*. The difference is in the cap, for, instead of being a plain or reticulate membrane with the gleba on the outer surface, it consists of minutely convoluted folds, the gleba permeating the depression between the folds. The cap is conical, olive-colored because of the mass of spores covering the surface. The stem is white and cylindrical, slightly tapering toward the top. The cap is in the form of a sheath covering the end of the stem at the base, dark gray. The net is very coarse, but a little finer below.

Genus PHALLUS Persoon

The cap is in the form of a disc, attached by the apex to the end of a hollow, cylindrical, spongy, porous, stemlike receptacle, and covered on the outside with a sticky mass of spores. The egg is globose or egg-shaped, torn above into irregular rounded projections by the developing receptacle, leaving a volva at the base.

The members of this genus grow on the ground.

PHALLUS TENUIS Lloyd. Kabuteng dilau na mabaho ⁷¹ (Tag.); óóng tí uleg (Ilk.). Poisonous. Plate 67.

A cylindrical mushroom, resembling a young seedling just broken off from the seed. The cap and the stalk are yellow, the cup is white. When dried, the specimen appears like a thin skin, similar to that of a snake after molting. This plant has only a very rudimentary veil, and often even this is lacking. The odor of the young plant is quite pleasant, but the matured and decaying fungus, like other phalloids, emits a very offensive odor. It grows on the ground from June to September.

The whole plant is 10 to 12 centimeters long, 0.8 to 1.2 centimeters in diameter. The cap is very thin, 9 to 13 millimeters in diameter and 2 to 2.5 centimeters long. The egg is about 3 centimeters long and 2 centimeters wide.

Genus MUTINUS Fries

The egg is white, round, oval or oblong, splitting into two or three round lobes. The receptacle is hollow, cylindrical, or spindle-shaped. The cap is apical, broadly attached to the stem, covered on the surface with a sticky mass of spores.

This genus differs from *Phallus* in having the cap wholly attached to the stem, while in the latter the cap is attached by the apex to the end of the receptacle by a narrow disc.

MUTINUS BAMBUSINUS (Zollinger) E. Fischer. Kabuteng pula na mabaho ⁷² (Tag.); óóng tí uleg (Ilk.). Poisonous. Plate 68.

This mushroom grows commonly on rotten leaves and in rich soil, often near bamboo stumps. It can be found from June to December. It is beautiful but not edible.

The plant is from 6 to 8 centimeters high and 1 to 1.6 centimeters thick at the center. The volva is white, 2 to 3 centimeters in diameter, 2.5 to 4 centimeters long. The cap is gradually tapering upward to a pointed end, and joined at the base with the stalk, at first covered with green mucus, which soon be-

⁷¹ Yellow foetid mushroom.

⁷² Red foetid mushroom.

comes red. The stem is elongated, spindle-shaped, cellular, rosy red above, fading downward until it becomes white below. Sometimes the plant branches out at the cap. In youth it has the shape of an egg. It is white, covered with a thick mucous membrane.

Genus ANTHURUS Kalchbrenner

The pouchlike peridium is composed of three layers; the outer layer is scurvy and thin, the middle one thick and gelatinous, and the inner thin, shiny, and smooth. The receptacle is short, cylindrical, hollow, bearing apically three to eight simple, brittle arms that are originally united apically and often breaking at maturity. The gleba is borne on the inner surface of the arms, moist, sticky, approaching olive color.

The species of this genus are quite rare. They are all poisonous and emit a very offensive odor.

ANTHURUS BROWNII Mendoza. Kamay ng patay⁷³ (Tag.). Poisonous. Plate 69.

The fruit body in youth is inversely egg-shaped, white, rough, 3 to 5 centimeters in diameter. The receptacle is stalked, short, cylindrical, hollow, up to 5 centimeters long, about 4 centimeters in diameter, thin, white throughout, broader at the top than below, divided into arms; the arms are white, 3.5 to 6 centimeters long, finely wrinkled on the interior, longitudinally sutured at the outside, united in youth, soon breaking off at the apex. Several fingers are two-branched at the extremities. The mucilaginous gleba is borne on the inner surface of the arms.

This mushroom is extremely fœtid. It is found in sandy soil mixed with decayed organic matter, where it appears from June to about November.

The Tagalog name refers to its appearance when the volva is removed, showing only the receptacle and the segments.

LYCOPERDACEÆ

PUFFBALLS

The puffballs are generally more or less round or inversely egg-shaped, and when young they are solid throughout. Within the walls of the spore-bearing body practically all the tissues differentiate at maturity into a mass of countless, dry, colored spores. Some of the smaller kinds at maturity develop a mouth, or opening, at the apex. When disturbed by a physical force

⁷³ Dead man's fingers.

they appear to send out smoke, due to the very numerous spores that burst out in a dark cloud through the mouth or opening. Many of the larger puffballs develop no terminal aperture or mouth. In this case spores are liberated only with the general breaking of the wall itself. Besides the wall, the only portion of the fruiting body that does not take part in the formation of the spores in the true puffball is the sterile base. This sterile base in certain species persists in characteristic form until the following season. The puffballs are found in woods, fields, and pastures. Many species are very small, but some are gigantic. When young, and practically up to the time of attaining full size, nearly all puffballs possess white flesh, and so long as this inner tissue is white, the puffballs are edible. However, when bruised or attacked by insects or bacteria, the flesh becomes yellowish, purplish, or otherwise discolored, rendering this fungus unfit for the table.

Genus BOVISTA Persoon

These plants are round or nearly round. They are attached centrally at the base. The outer covering is thin and fragile, flaking off at maturity and leaving exposed the smooth, thin, swollen, metallic-looking inner coating which opens by an apical mouth. Soon it becomes detached from the ground and is blown about like a light ball pouring out the spores. The spores are dark brown, or purplish brown in mass.

These mushrooms are found in open fields, pastures, and lawns. All the species when young are edible. This genus differs from *Lycoperdon* in the absence of a sterile base.

BOVISTA PILA Berkeley & Curtis. Parapara (Ilk.); tombong (Tag.). Edible. Plate 70, fig. 1.

The Ilocano and Tagalog names of this mushroom refer to its likeness to the roundish, white embryo plant that is inside the coconut. It is common in grassy fields, pastures, and lawns, from May to October. It is edible when young. The Ilocanos cook it with vegetables. For better cooking, the plant is sliced, coated with flour, then fried in butter or shortening. It is soft and palatable, and the taste is like that of calf brain.

The plant is round or nearly so, irregularly pointed downward, 0.8 to 3 centimeters in diameter, attached abruptly below by a simple, small mycelium strand which breaks at maturity. The outer covering is very thin, about 0.25 millimeter thick, pure white, tending to become pinkish or grayish yellow when

handled. The surface is delicately powdered, becoming more or less irregularly channeled, flaking off in patches at maturity. The inner wall when exposed is smooth and shining, more or less bronze-colored and splotched with blackish or gray areas, the effect being a metallic appearance like burnt copper. It soon opens at the top by an irregular pore or by extensive splitting and flaking.

Genus CALVATIA Fries

The plants are large, round, flattened or toplike, in appearance, or of some other similar form. The sterile stalklike base is either present or absent. The outer covering is thick, woven, or divided into small spaces. The inner covering is thin, delicate, not opening by a pore but falling away irregularly in scales and plates, soon exposing the densely woven mass of threads called *capillitium*. The sterile base is concave above, persisting a long time as a cup-shaped remnant. This genus is easily distinguished from *Lycoperdon* by the irregular scaling away of the outer wall at maturity, and in most species by the fragility of the *capillitium*. The genus includes the large puffballs. The latter are important as food and should be used whenever found in the young stage. The ripe *Calvatia* applied to a bleeding wound is said to stop the flow of blood.

CALVATIA LILACINA Fries. Tombong (Tag.); parapara (Ilok.). Edible. Plate 70, fig. 2.

This mushroom is very common in grassy fields and in pastures. It grows very abundantly and can be collected by the bushel during favorable rainy weather in June and July. It may be found from May to December, and sometimes much later in the mushroom season, when there are occasional heavy rains. This is the largest puffball in the Philippines. The writer ate plenty of this mushroom while it was still very young and white inside. The plant is sliced in fine pieces, thinly coated with flour, and fried in shortening or butter. It is soft and tastes like calf brain.

The plant is broadly inversely egg-shaped or top-shaped, 5 to 10 centimeters high and 5 to 8 centimeters in diameter, contracted below into a stout, cellular, stemlike base; the covering is white, polished, becoming yellowish brown or dark gray with age, and soon breaks away in papery patches. The peridium or the whole spore body is thin and evanescent above, bursting by a large opening when mature. The sterile base remains persistent a long time as a cup-shaped remnant.

This mushroom forms a fairy ring.

Genus LYCOPERDON Linnæus

The generic name *Lycoperdon*, derived from the Greek words *lukos*, meaning "wolf," and *perdon*, "dung," probably was given to this mushroom by the people in a country where wolves abound.

These plants are comparatively small, globose, inversely egg-shaped or top-shaped. The base in most of the species is filled with a sterile, honey-combed tissue. The wall is composed of two layers—an outer layer which becomes broken up into spinelike tufts or warts, and an inner, smooth layer which opens spontaneously when mature by a small apical mouth or by the gradual falling away of the upper surface. The gleba, or internal tissue, is composed of minute chambers. It is white when young, changing as the plant ripens through yellowish or olive to brown or purplish.

LYCOPERDON PYRIFORME Schaeffer. Tombong (Tag.); parapara (Ilk.). Edible. Plate 71, fig. 1.

This is a small puffball which grows in dense clusters on decaying wood and well-disintegrated vegetable matter. It is common in the forest. The color is white or light brown, and the surface is covered with minute wartlike scales. The stem is very short or almost lacking, but there are always netlike strands of mycelium extending from the base of the mushroom into the rotten wood. The plant is 3 to 4.5 centimeters broad and 3 to 5 centimeters high, usually much smaller. It is edible and can be cooked like other puffballs.

Genus SCLERODERMA Persoon

The fruit body is sessile, or prolonged with a short stemlike base. The wall is firm, leathery or corky, smooth, warted, scaly or granular, breaking irregularly, and in a more or less stellate manner. The gleba is traversed by sterile veins and finally becomes powdery. All the species of this genus are terrestrial.

SCLERODERMA GEASTER Fries. Parapara (Ilk.); tubó (Tag.). Tough. Plate 71, fig. 2.

The plant is 3.5 to 7 centimeters in diameter when closed, up to 10 centimeters when open, nearly round, often irregular, with a rounded projection on top, not infrequently growing more than half buried in the ground; at the base it is connected with strands of cottony mycelium; the covering is hard and rigid,

about 6 millimeters thick when fresh, and 1 to 3 millimeters thick when dry, white when young, later turning yellow, dull yellow to straw-colored, and then cracking into scales, splitting up irregularly at maturity into a varying number of lobes which curl back as they dry and expose the dark spore mass which is brown when fully mature. The stem is absent.

The specific name is taken from the way in which the covering cracks up, resulting in a more or less stellate form resembling that of the genus *Geaster*.

This is the only true puffball that is never edible.

Genus *GEASTER* Micheli

Geaster is taken from the Greek words *ge*, which means "earth," and *aster* "star"—referring to the starlike appearance of the mature plant.

The species of this genus are terrestrial, very common, and generally found in great numbers in thickets and under bamboo trees, generally in the forests. They are interesting because of their starlike form. None of them are edible.

GEASTER HYGROMETRICUS Persoon. Bituing lupa⁷⁴ (Tag.). Not edible. Plate 72.

The specific name is taken from the Greek words *hygros*, "moisture," and *metron*, "measure," and refers to the absorption by this species of moisture from the air.

The plant when expanded is 1.5 to 3.5 centimeters in diameter and up to 3.5 centimeters tall, excluding the basal cap. The outer covering is gray or grayish brown, the inner brownish, and becoming deeply cracked, round, tough, leathery, cartilaginous, soon splitting almost to the base into five to seven acute lobes in a stellate manner. The spore sac is sessile, egg-shaped, round, woolly, gray or brown, opening spontaneously when mature by a small special mouth. The aperture is narrow, irregularly torn. The spore mass is dark brown.

These fungi are strongly sensitive to moisture, and in moist weather recurve and, standing on their tips, lift up the inner ball. In dry weather they curve in closely, clasping the ball. This process is repeated every time there is a change in moisture. This mushroom is very common in the forests, growing on decayed leaves and rubbish, often under wild bamboo trees. It is found in groups of many, from May to March. It is not edible.

⁷⁴ Earth star.

Family NIDULARIACEÆ Fischer

THE BIRD'S-NEST FUNGI

The fruiting body in the members of this family is funnel-shaped or round, leathery or fleshy-leathery. The opening is the entire top, exposing one to many roundish "peridioles" or eggs. Three or four eggs are usually attached by a cord to the wall of the fruiting body. The typical members of the family are popularly known as "bird's-nest fungi."

Genus CYATHUS Haller

The name *Cyathus* is taken from the Greek word *kuathos*, "wine cup," and refers to the cuplike shape of the members of this genus.

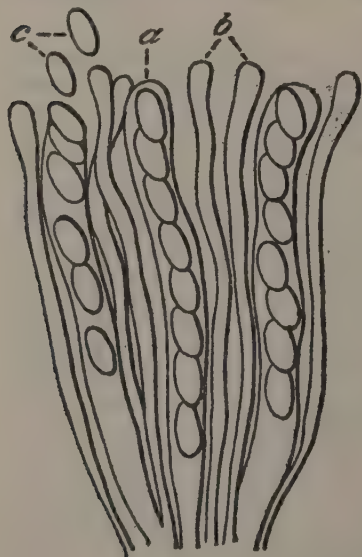


FIG. 5. Cross section of the fruiting body of Ascomycetes. *a*, Ascus; *b*, paraphyses; *c*, spores; highly magnified.

The fruit body is cylindrical to bell-shaped, with a wall which consists of three distinct, closely connected layers. This wall is closed at first, with a membranous covering, which finally ruptures and disappears. The numerous peridioles are compressed, depressed in the middle, and attached to the inner wall of the peridium by a short cord, technically called "funiculus."

CYATHUS STRIATUS Hoffmann. Pugad ñg ibon⁷⁵ (Tag.). Not edible. Plate 73.

A very common fungus found all year round, but most abundant during the rainy season. It grows in groups, generally on rotten bamboo and old rotten boxes. The Tagalog name refers to its nestlike appearance,

caused by the egglike structures inside.

The fruiting body is reddish brown or iron-rust-colored, covered externally with sharp hair, inversely conical or bell-shaped, 8 to 13 millimeters high, 6 to 9 millimeters in diameter; the apex at first is incurved and closed in by a pale membrane,

⁷⁵ Bird's nest.

then opens and shows the lead-colored, grooved, inner surface. The peridioles or eggs are whitish and nearly round.

Class ASCOMYCETES

The use of the microscope is necessary in determining the distinguishing characters of the class Ascomycetes, because most of them cannot be seen by the naked eye. These distinguishing characters (text fig. 5) are the "asci" (sing. "ascus") which are club-shaped or cylindrical and typically contain eight "ascospores." Some members of this class, because of their size and economic value, should be included among the mushrooms herein described. The morels, *Xylaria* and *Peziza*, are but a few examples.

Order DISCOMYCETES

The fruiting body in this order is generally in the form of a cup. At first it is closed, but it soon opens and expands with growth, often finally becoming convex, and either sessile or borne on a stalk. It is almost always simple, but may be compound, as in *Morchella* (Plate 74, fig. 1). The hymenium is spread over the upper surface of the cap as a distinct membrane.

Genus MORCHELLA Dillenius

Morchella is from the German word *Morchel*, which means "morel."

The morels are all edible, and they are usually easy to recognize. The plants consist of two distinct prominent parts, the cap and stem. The cap is nearly globose or elongated, blunt or sharply pointed at the apex. It is always marked by rather broad pits covering the entire surface. These pits are separated from each other by ridges forming a network. The arrangement of the pits on the surface is regarded as characteristic of certain species. The fruiting body is yellow to brown. The stem is usually quite stout, though it varies to some extent in some of the different species in proportion to the thickness of the cap. The stem is marked in some of the species by large wrinkles or folds extending irregularly but with considerable uniformity over the surface. The surface is further minutely roughened by whitish or grayish elevations, giving it a granular appearance. Sometimes these granules are quite evenly distributed over the surface, and in some species they are more or less separated into small areas by narrow lines.

The morels should always be carefully washed before cooking. Soaking for some time in salt water will improve them and insure the absence of any insects that might be within the pits. Fried in butter or fat, they are delicious.

MORCHELLA ESCULENTA Persoon. Kabuteng hugis utak ⁷⁶ (Tag.). Edible. Plate 74, fig. 1.

The specific name *esculenta* is a Latin word, meaning "edible." The common name has reference to the indentation of the fungus, which is like that of a brain.

The plant is from 5 to 15 centimeters high. The stem is 1 to 3 centimeters thick, hollow, and the cap is broader than the stem, more or less oval or rounded in outline. In this species the pits are irregularly arranged, so that they do not form rows, and the ridges separating them do not run longitudinally from the base toward the apex of the cap. The flesh is waxy and brittle. The taste and smell are pleasant.

This mushroom appears from May to September, and is abundant during the wet months. It is found on the ground in the forest where it is cool and moist.

Genus PEZIZA (Dillenius) Linnæus

The fruit body is sessile, or sometimes narrowed below into a short stemlike base, even, provided with little knots or nodules, or veined, at first closed, then expanding until cup-shaped, disc-shaped, or sometimes plane or even convex. The exterior is warted, scurfy, or fairly smooth. The plants are fleshy and brittle. All the larger species are probably edible.

PEZIZA POSTULATA (Hedwig) Persoon. Kabuteng hugis kopa ⁷⁷ (Tag.). Plate 74, fig. 2.

A quite common cup-shaped mushroom, found growing on charcoal and burned areas. The edibility of this species in the Philippines is not yet determined. However, in the literature none of the species of *Peziza* are reported poisonous. This mushroom is frequently found in Manila from June to September.

This mushroom is pale brown to chocolate-brown. When young it is much lighter in color outside than inside. At first it is closed and nearly round, then it gradually expands, reaching a diameter of from 3 to 6 centimeters. It is regular or much distorted. The margin is irregular or with small round projections. The plant is quite tender and brittle.

⁷⁶ Brainlike mushroom.

⁷⁷ Cuplike mushroom.

PEZIZA SULCIPES Berkeley. Plate 75, fig. 1.

The disc is stalked or nearly so, cup-shaped, 1 to 3 centimeters in diameter and about 1 centimeter deep, sometimes more shallow, on the other side often marked with several concentric rings near the margin, which is fringed with very fine, short, yellowish hairs; the surface is deep orange to nearly scarlet, fading with age. The stem is often short, so that the cup appears to be without a stalk, but sometimes it reaches a length of 3 centimeters, and 1 to 2.5 millimeters in diameter.

This fungus is very common in the forest, growing on old wood and bark. It can be found from May to December.

PEZIZA TRICHOLOMA Montagne. Kabuteng kopang pula⁷⁸ (Tag.). Plate 75, fig. 2.

A very common mushroom, growing on wood and bark of trees, especially on dried branches.

The fruiting body has a stem that is 2 to 3 centimeters long and 1.5 to 2.5 millimeters in diameter. Sometimes the stem is very short, so that the fungus looks sessile. The margin of the cap reaches a diameter of 1 to 2 centimeters and a depth of 1 centimeter or more. It is densely covered with numerous long whitish or pale-brown hairs that are tapering upward. The cup is deep red, fading in drying.

This mushroom is very similar to *P. sulcipes* in appearance. It differs, however, in that *P. sulcipes* is deep orange-colored, and covered with only very fine, short, scanty hairs, while *P. tricholoma* is deep red in color and covered with abundant, long hairs.

PEZIZA VESICULOSA Bulliard. Kabuteng kopang maputiputi⁷⁹ (Tag.). Edible. Plate 76.

This mushroom grows in groups or scattered, and is generally found on rich sticky soil. At first it is hemispherical, and early distorted in outline, later expanded, with the margin broken into irregular round projections. The plant is whitish outside and pale brown inside, 3 to 6 centimeters in diameter. The stalk is absent. The flesh is soft and white, and has a pleasant odor and taste.

This mushroom can be found from May to October.

Genus XYLARIA Hill

The generic name *Xylaria* is taken from the Greek word *xylon*, meaning "wood," and refers to the texture of the members of this genus.

⁷⁸ Red-cupped mushroom.

⁷⁹ Light-colored cup mushroom.

The fruit body is black, erect or ascending, cylindrical, club-shaped or threadlike, often compressed, simple or branched, corky or leathery.

The species of this genus usually grow on or near wood.

XYLARIA BIFORMIS Lloyd. Plate 77, fig. 1.

A queer-looking mushroom, resembling the anther of a deer or the horn of a beetle. It is very common in moist places, growing on rotten wood in the forest. It can be found all year round, but is most abundant from May to October.

The whole plant is 3 to 12 centimeters long and 0.3 to 1 centimeter in diameter. The stem is more or less twisted, rather rugged, short, and reaches about 1 centimeter in length. The antherlike branches are 0.5 to 3 centimeters long, and 1 to 5 millimeters in diameter, tapering towards the end. The color is brown to dark brown. This mushroom is tough and when dried becomes brittle.

XYLARIA DEALBATA Berkeley and Curtis. Plate 77, fig. 2.

Another club-shaped mushroom, which grows on rotten wood, generally the bagtikan, and very common in the forests. It can be found from May to December.

At first it is straw-colored, becoming dark in age. It is cylindrical, blunt at the end, more or less rugged or rough, and somewhat tough. The whole plant is 3 to 10 centimeters long, 0.8 to 1.5 centimeters in diameter. There is no well-defined stem. The base is provided with a round structure for attachment. This mushroom has no definite shape, although it is commonly cylindrical. Sometimes it is cut abruptly near the top, but a growth of short cylindrical forms is continued upward.

This mushroom is too tough to be edible.

XYLARIA EUGLOSA Fries. Plate 78, fig. 1.

A club-shaped mushroom, often found in the forests growing on rotten wood and sometimes on living trees. It is tough, becoming hard and brittle in age. It can be found from May to December.

This mushroom is at first smooth, clay-colored, later rough, dark brown, and blackening. The inside tissue is white to ash-colored. The stem is short, often not distinct. It is enlarged at the base. The whole plant is 4.5 to 6 centimeters long, 0.8 to 1.4 centimeters in diameter.

XYLARIA PISTILARIS Lloyd. Kabuteng maitim na daliri (Tag.). Plate 79, fig. 1.

This is a common, large mushroom that is found in groups, sometimes growing together at the base of prostrate trunks and stumps. In appearance it resembles a black finger, hence its Tagalog name. It is found from June to September.

This mushroom is tough to woody in texture. The whole black fingerlike fruiting body is called *stroma*. At the tip and the portion near it, where the process of growth has just been taking place, the color is white or pale. Later the whole surface becomes entirely black. The inside part of the plant is white. It is 14 to 15 centimeters long and 4 to 8 centimeters in diameter.

XYLARIA RIDLEYI Massee. Plate 78, fig. 2.

This species grows on rotten wood in humid places in the forests. It is common in the Philippines. When young, it is white inside, becoming dark or sooty in age. Sometimes the inside portion disintegrates and later disappears, leaving only the walls that are usually split. The whole plant is 2 to 5 centimeters long, 3 to 7 millimeters in diameter. It is club-shaped and blunt at the end. The lower portion is rough and rugged and assumes a stemlike form. Oftentimes the whole plant forms into biceps, uniting at the base and at the tip.

This mushroom is too tough to be edible.

Genus **DALDINIA** de Notaris

The distinctive character of this genus is the zonate arrangement of the stroma (the cushionlike fruiting body) which consists of white or pale pithy layers alternating with narrow black carbonaceous layers. These zones are of different textures and color. When young and growing, the members of this genus are covered with an iron-rust-colored conidial layer. This is the usual condition during dry weather. In maturity this layer disappears and the surface becomes black, smooth, and shiny.

DALDINIA CONCENTRICA (Bolton) Cestadi and de Notaris. Kabuteng matigas at mabilog⁸⁰ (Tag.). Plate 79, fig. 2.

This is a hard mushroom, very common and abundant on old trunks of trees and rotten bamboos. It is found all year round.

This fungus is usually roundish, not stalked, varying from 2 to 3.5 centimeters in diameter. It is brown at first, then black,

⁸⁰ Round, hard mushroom.

and easily recognized by the concentrically-zoned flesh. It appears often in groups, although generally single.

This mushroom is too hard and brittle to be edible.

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[The author makes no claim of having covered all mushrooms found in the Philippines. Additional information on mushrooms in the Philippines can be obtained from the publications listed below. Although these publications are largely from foreign countries, they are useful locally in that many mushrooms growing in the Philippines are also found in other countries. Substantial literature on Philippine mushrooms is very limited; the most valuable references are those of Graff and of Copeland.

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ILLUSTRATIONS

[Plate 12 is a water-color drawing by Victoriano V. Marasigan; Plates 38 and 65 are water-color drawings by Gerardo Garcia and Plates 23, 24, and 55, by Pedro L. Ramos. Plates 14, 16, 21, 42, 62, and 68 are reproduced from oil paintings by Pedro L. Ramos; Plate 17 is from an oil painting by Bienvenido Alcantara.]

PLATE 1. SPAWNS.

- FIG. 1. Commercial spawn in bottle form.
2. Commercial spawn in brick form.
3. Natural or virgin spawn.

PLATE 2

Button stage of *Lepiota cepaestipes*.

PLATE 3

Tragedy in a coffee plantation. *Pleurotus* sp. attacking a coffee tree.

PLATE 4

Lentinus sajor-caju, living on a dead tree.

PLATE 5

Fairy ring of *Psalliota perfuscus*.

PLATE 6. IMPORTED MUSHROOMS.

- FIG. 1. *Pleurotus ostreatus*, from China.
2. *Auricularia* spp., from China.
3. *Cortinarius Shiitake*, from Japan.

PLATE 7. MUSHROOM CULTURE.

- FIG. 1. Mushroom culture in Ilocano and Pangasinan provinces.
2. Waste of abacá fiber, palay straw, banana trunks, and empty rice sacks piled together as a bed.

PLATE 8

Volvaria esculenta, growing on a stack of rice straw.

PLATE 9

Volvaria esculenta, growing on decayed rice straw and animal dung.

PLATE 10. SPORE PRINTS.

- FIG. 1. Spore print of a purple-brown-spored agaric, *Psalliota perfuscus*.
2. Spore print of a white-spored agaric, *Lepiota cepaestipes*.

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2. <i>Tricholoma panæolum.</i>	
	PLATE 29
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PLATE 30

- FIG. 1. *Pleurotus cornucopiæ*.
 2. *Pleurotus limpidus*.
 3. *Pleurotus ostreatus*.

PLATE 31

- FIG. 1. *Pleurotus opuntiae*.
 2. *Pleurotus porrigens*.
 3. *Pleurotus pulmonaris*.

PLATE 32

- FIG. 1. *Clitocybe luscina*.
 2. *Clitocybe phyllophylla*.

PLATE 33

- FIG. 1. *Clitocybe multiceps*.
 2. *Schizophyllum alneum* (= *Schizophyllum commune*).

PLATE 34

- FIG. 1. *Marasmius hæmatocephalus*.
 2. *Marasmius pilopus*.

PLATE 35

- FIG. 1. *Cantharellus aureus*.
 2. *Lentinus auracariæ*.

PLATE 36

- FIG. 1. *Panus rudis*.
 2. *Lentinus infundibuliformis*.

PLATE 37

- FIG. 1. *Lentinus elmerianus*.
 2. *Lentinus ramosii*.

PLATE 38

Lentinus exilis.

PLATE 39

- FIG. 1. *Lentinus fusco-purpureus*.
 2. *Lentinus squarrosulus*.

PLATE 40

- FIG. 1. *Lentinus prærigidus*.
 2. *Lentinus sajor-caju*.

PLATE 41

- FIG. 1. *Volvaria cinerescens*.
 2. *Pluteus cervinus*.

PLATE 42

Volvaria esculenta.

PLATE 43

- FIG. 1. *Volvaria pruinosa*.
 2. *Pluteus longistriatus*.

PLATE 44

- FIG. 1. *Cortinarius collisteus*.
 2. *Galera tenera*.

- PLATE 45
- Naucoria semiorbicularis.*
- PLATE 46
- FIG. 1. *Pluteulus coprophilus.*
2. *Phoiota aurivella.*
- PLATE 47
- FIG. 1. *Psalliota argyrosticta.*
2. *Psalliota merrillii.*
- PLATE 48
- FIG. 1. *Psalliota campestris.*
2. *Psalliota campestris* var. *edulis.*
- PLATE 49
- FIG. 1. *Psalliota campestris* var. *umbrina.*
2. *Psalliota comtula.*
- PLATE 50
- FIG. 1. *Psalliota luzoniensis.*
2. *Psalliota perfuscus.*
- PLATE 51
- FIG. 1. *Stropharia semiglobata.*
2. *Copelandia papilionacea.*
- PLATE 52
- FIG. 1. *Coprinus comatus.*
2. *Coprinus confertus.*
- PLATE 53
- FIG. 1. *Coprinus plicatilis.*
2. *Panæolus campanulatus.*
3. *Psathyrella disseminata.*
- PLATE 54
- FIG. 1. *Boletus badius.*
2. *Boletus edulis.*
- PLATE 55
- Boletus castaneus.*
- PLATE 56
- FIG. 1. *Daedalea flavida.*
2. *Ganoderma mangiferæ.*
- PLATE 57
- FIG. 1. *Hexagona apiaria.*
2. *Polyporus sanguineus.*
- PLATE 58
- FIG. 1. *Fomes pachyphloeus.*
2. *Polyporus sulphureus.*
3. *Trametes aspera.*
- PLATE 59
- FIG. 1. *Hydnum erinaceus.*
2. *Hydnum velutinum.*

- | | |
|--|----------|
| | PLATE 60 |
| FIG. 1. <i>Clavaria crispa</i> . | |
| 2. <i>Clavaria zippelii</i> . | |
| | PLATE 61 |
| FIG. 1. <i>Clavaria stricta</i> . | |
| 2. <i>Auricularia affinis</i> . | |
| 3. <i>Auricularia delicata</i> . | |
| | PLATE 62 |
| <i>Auricularia auricula-judæ</i> . | |
| | PLATE 63 |
| FIG. 1. <i>Auricularia mesenterica</i> . | |
| 2. <i>Auricularia polytricha</i> . | |
| | PLATE 64 |
| FIG. 1. <i>Dictyophora duplicata</i> . | |
| 2. <i>Dictyophora</i> sp. | |
| | PLATE 65 |
| <i>Dictyophora phalloidea</i> . | |
| | PLATE 66 |
| <i>Clautriavia merulina</i> . | |
| | PLATE 67 |
| <i>Phallus tenuis</i> . | |
| | PLATE 68 |
| <i>Mutinus bambusinus</i> . | |
| | PLATE 69 |
| <i>Anthurus brownii</i> . | |
| | PLATE 70 |
| FIG. 1. <i>Bovista pila</i> . | |
| 2. <i>Calvatia lilacina</i> . | |
| | PLATE 71 |
| FIG. 1. <i>Lycoperdon pyriforme</i> . | |
| 2. <i>Scleroderma geaster</i> . | |
| | PLATE 72 |
| <i>Geaster hygrometricus</i> . | |
| | PLATE 73 |
| <i>Cyathus striatus</i> . | |
| | PLATE 74 |
| FIG. 1. <i>Morchella esculenta</i> . | |
| 2. <i>Peziza postulata</i> . | |
| | PLATE 75 |
| FIG. 1. <i>Peziza sulcipes</i> . | |
| 2. <i>Peziza tricholoma</i> . | |
| | PLATE 76 |
| <i>Peziza vesiculosa</i> . | |
| | PLATE 77 |
| FIG. 1. <i>Xylaria biformis</i> . | |
| 2. <i>Xylaria dealbata</i> . | |

PLATE 78

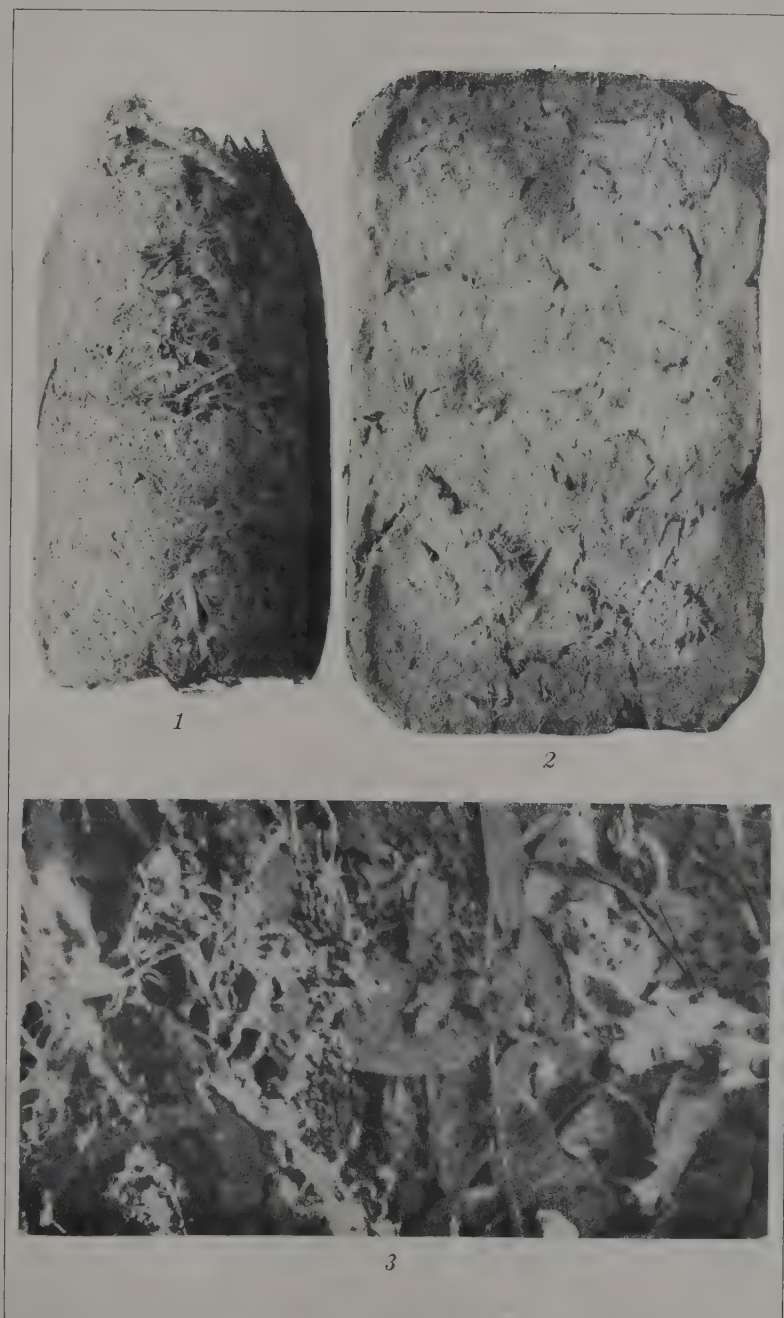
- FIG. 1. *Xylaria euglosa*.
2. *Xylaria ridleyi*.

PLATE 79

- FIG. 1. *Xylaria pistilaris*.
2. *Daldinia concentrica*.

TEXT FIGURES

- FIG. 1. Structure of a gill mushroom.
2. Cross section of a very small portion of a gill. *a*, Hyphæ; *b*, basidia; *c*, sterigmata; *d*, spores; *e*, cystidium; highly magnified.
3. Portion of the structure of agarics, showing the arrangement of gills. *a*, Gills free; *b*, gills adnate; *c*, gills sinuate; *d*, gills decurrent.
4. Portion of the structure of agarics, showing the different formations of the caps. *a*, Convex; *b*, campanulate or bell-shaped; *c*, conical.
5. Cross section of the fruiting body of Ascomycetes. *a*, Ascus; *b*, paraphyses; *c*, spores; highly magnified.



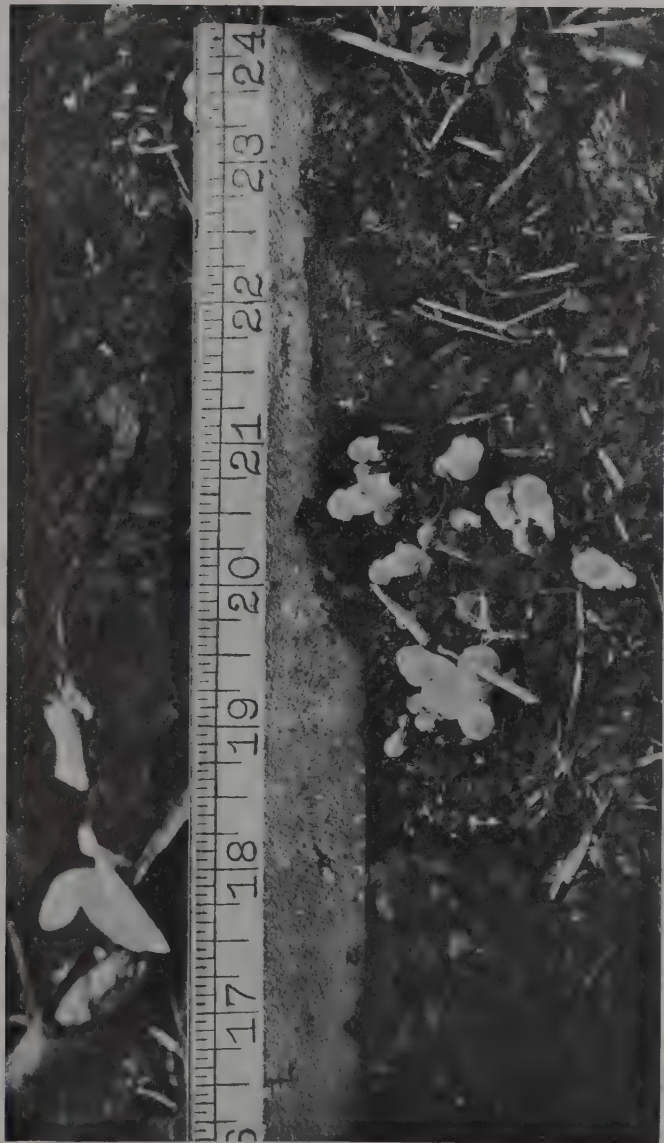


PLATE 2.

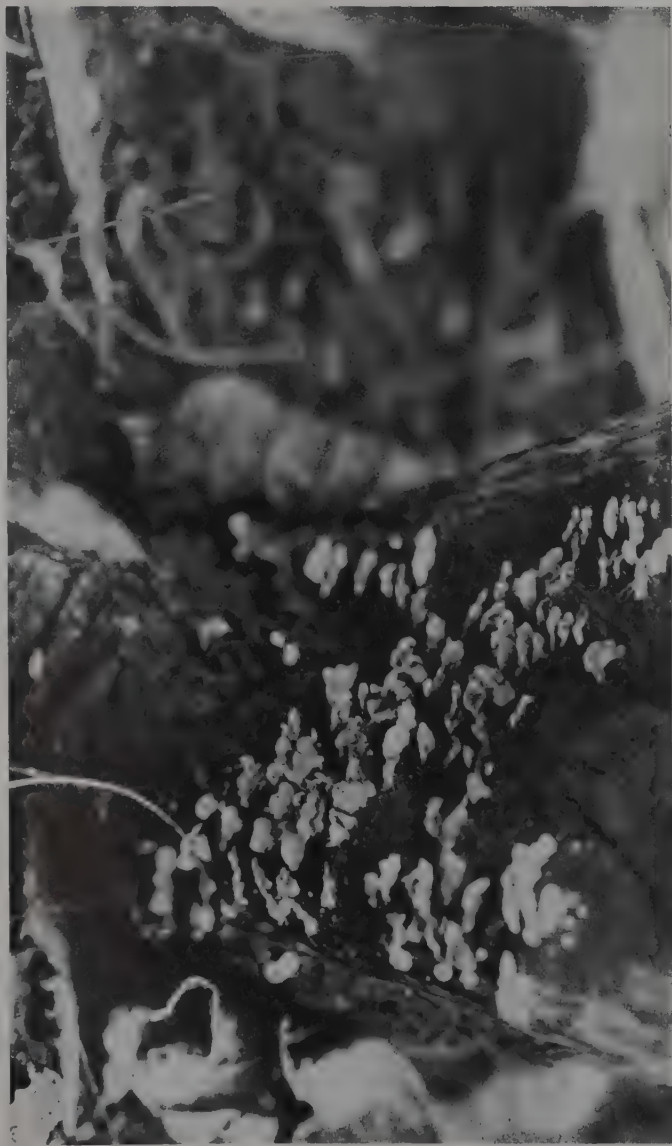


PLATE 3.

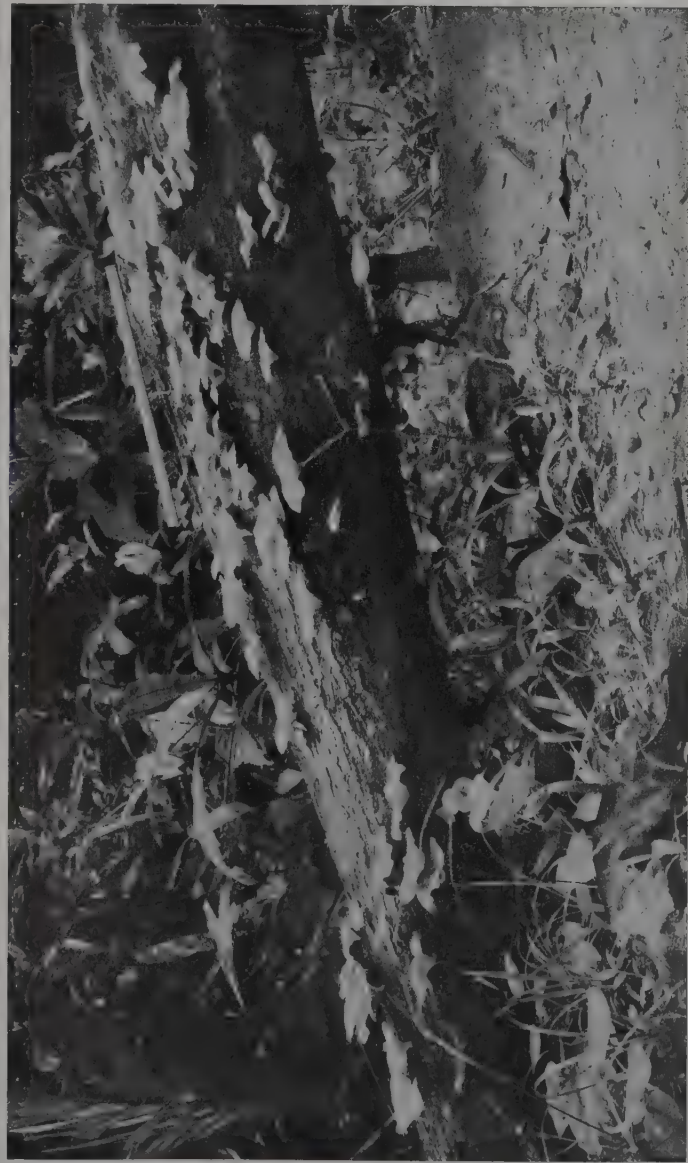


PLATE 4.

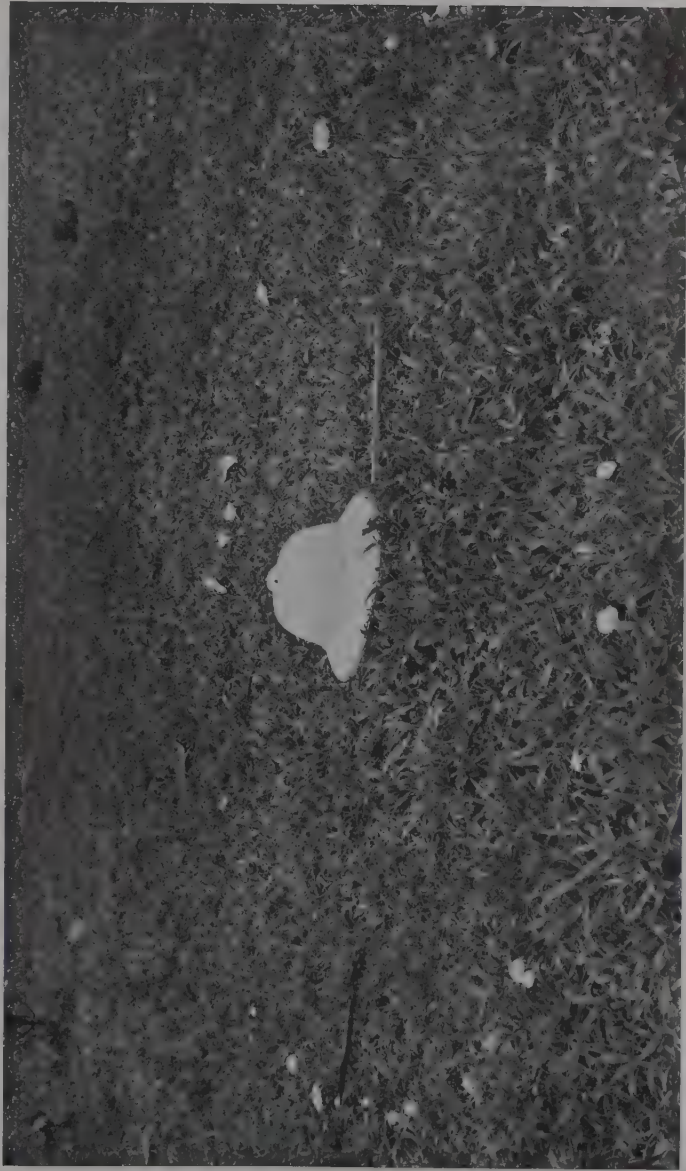


PLATE 5.

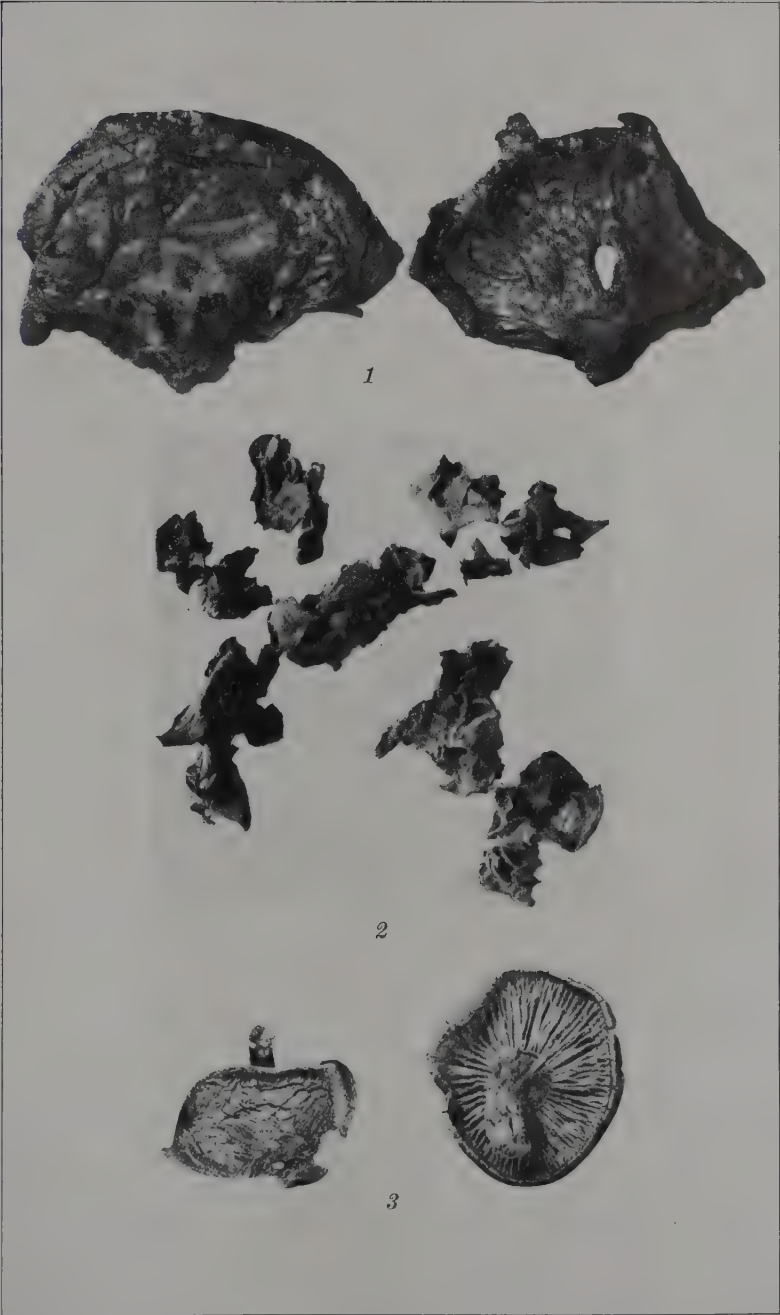


PLATE 6.



PLATE 7.



PLATE 8.

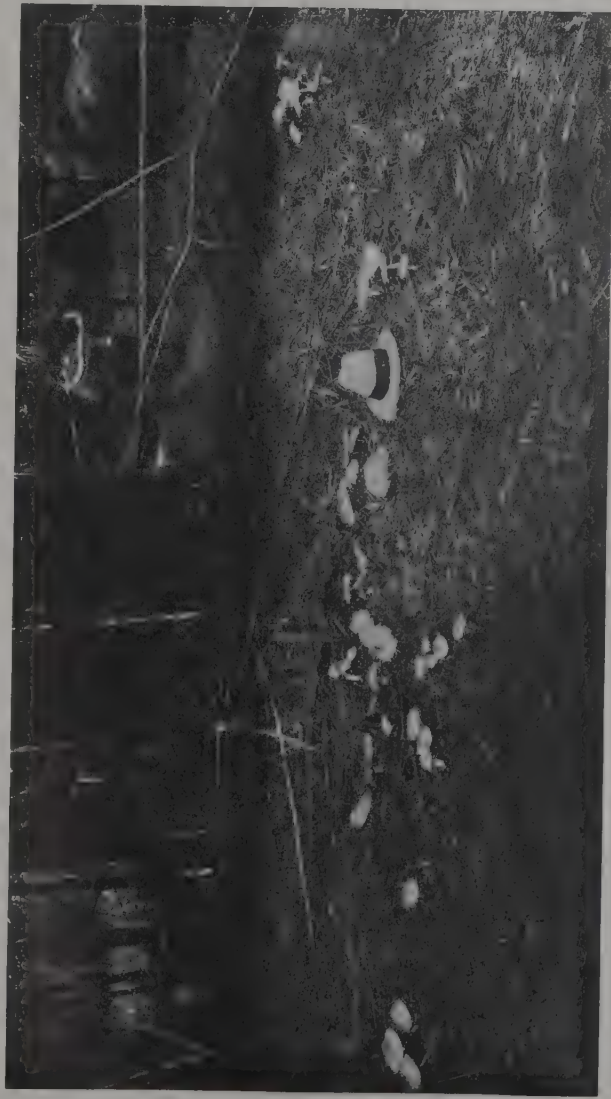
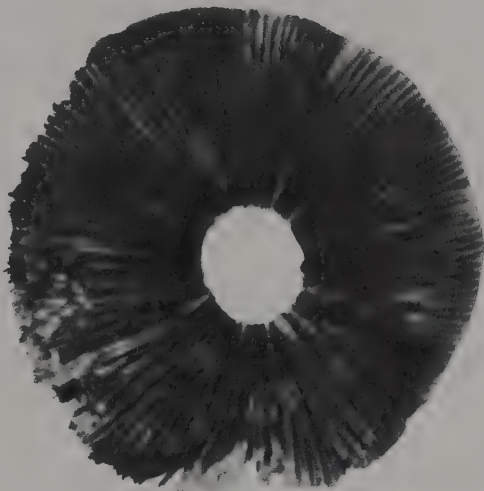


PLATE 9.



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PLATE 11.



PLATE 12.



PLATE 13.



PLATE 14.

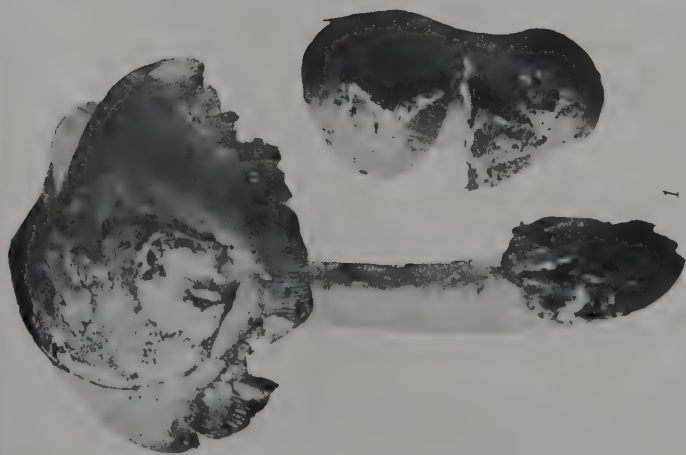


PLATE 15.



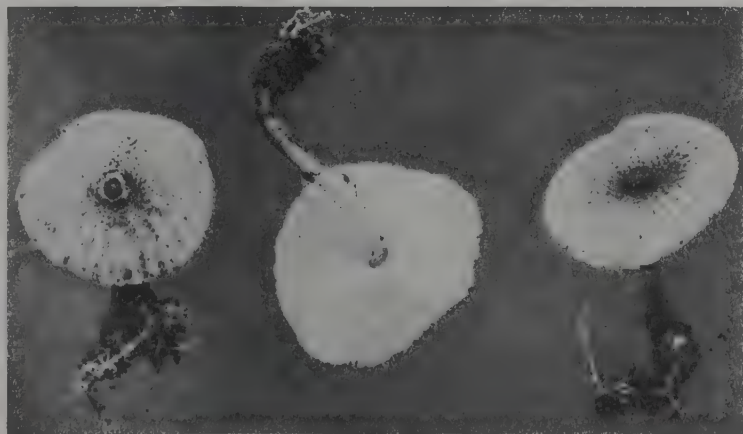
PLATE 16.



PLATE 17.



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PLATE 19.

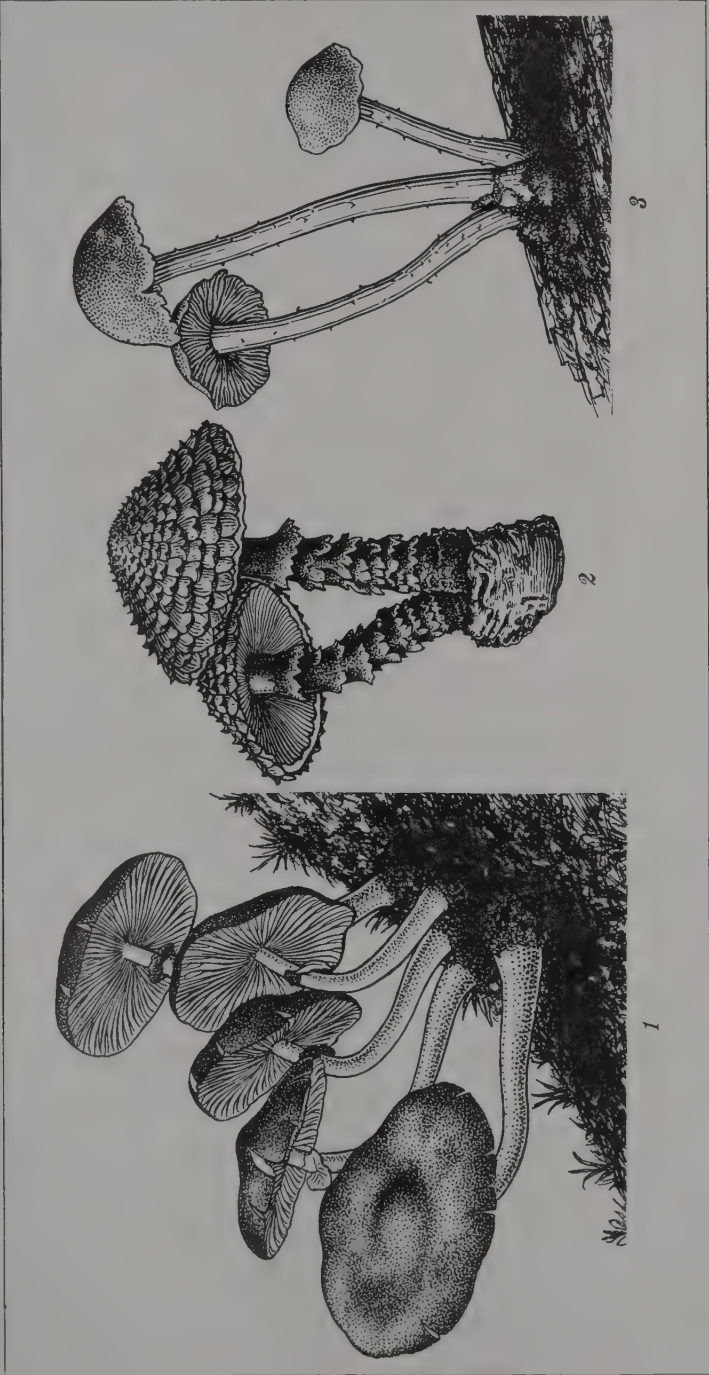


PLATE 20.



PLATE 21.



PLATE 22.



PLATE 23.



PLATE 24.

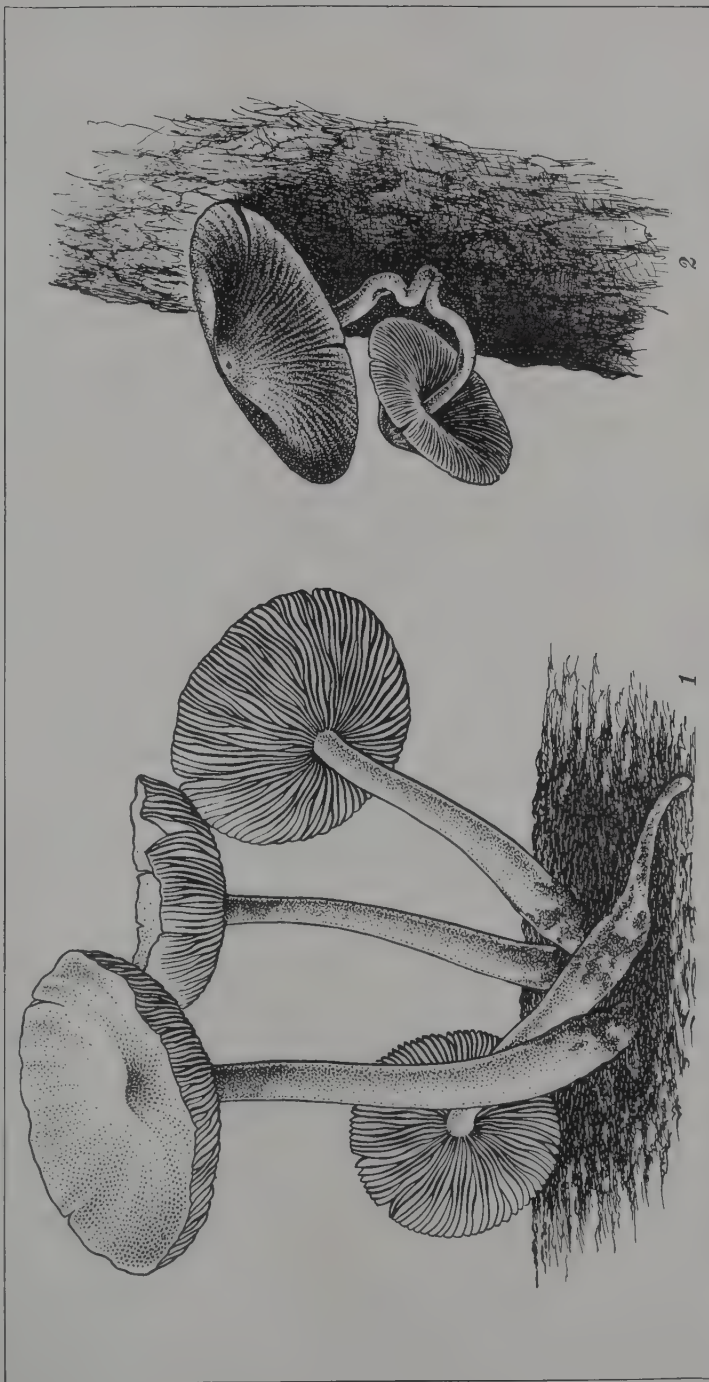


PLATE 25.



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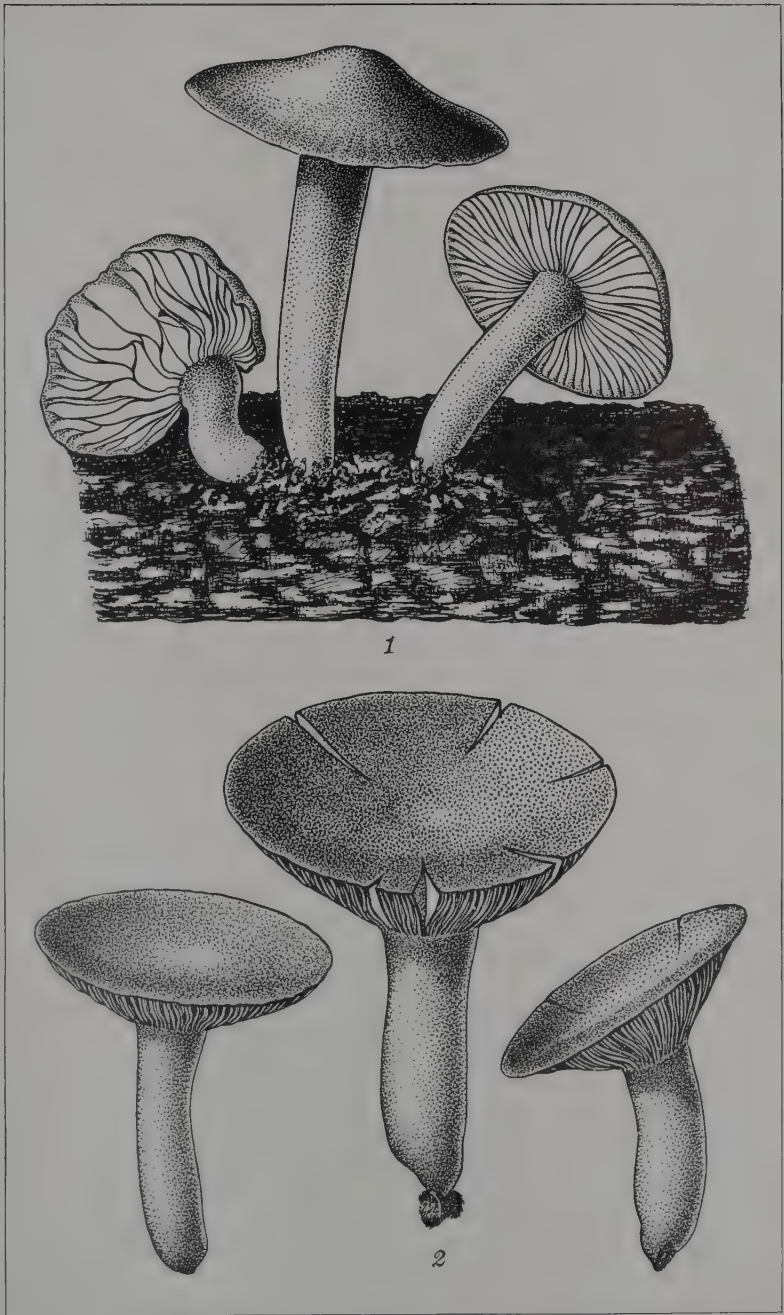


PLATE 27.



PLATE 28.



PLATE 29.



PLATE 30.

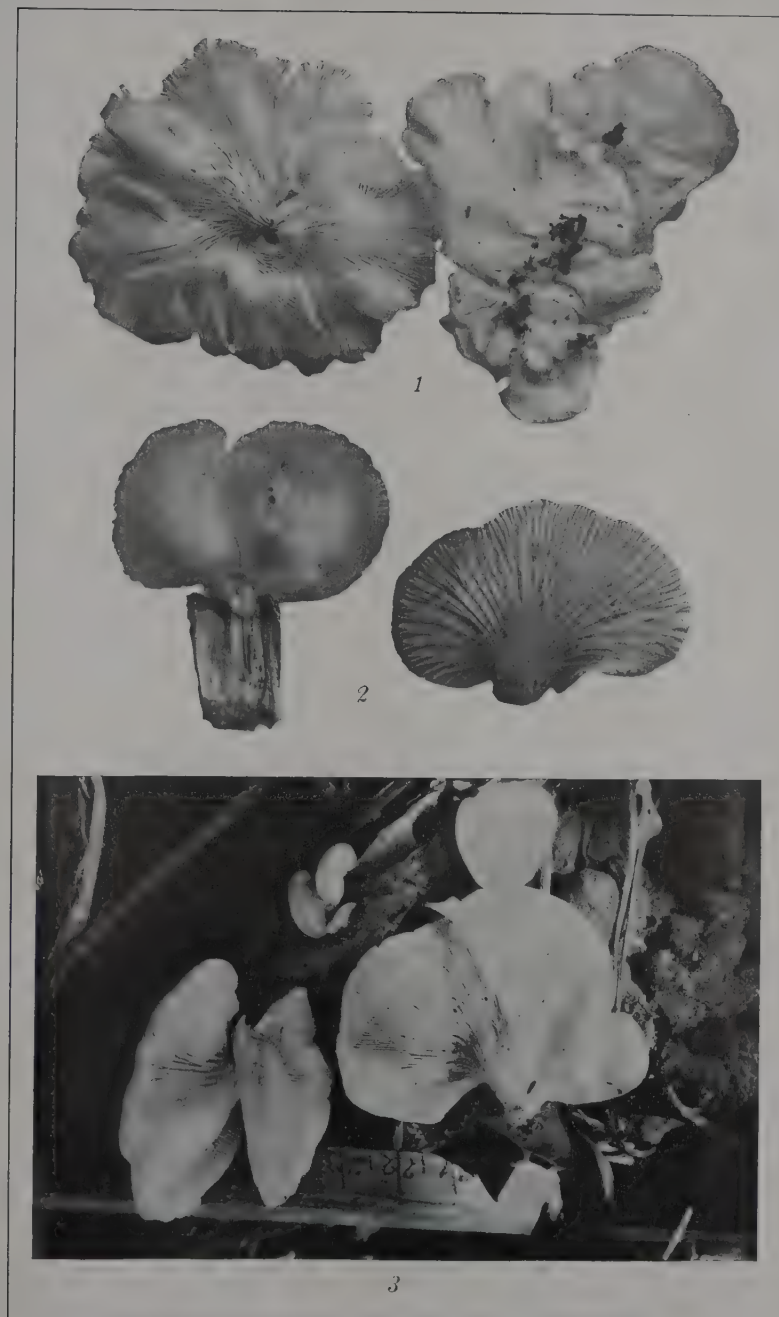




PLATE 32.

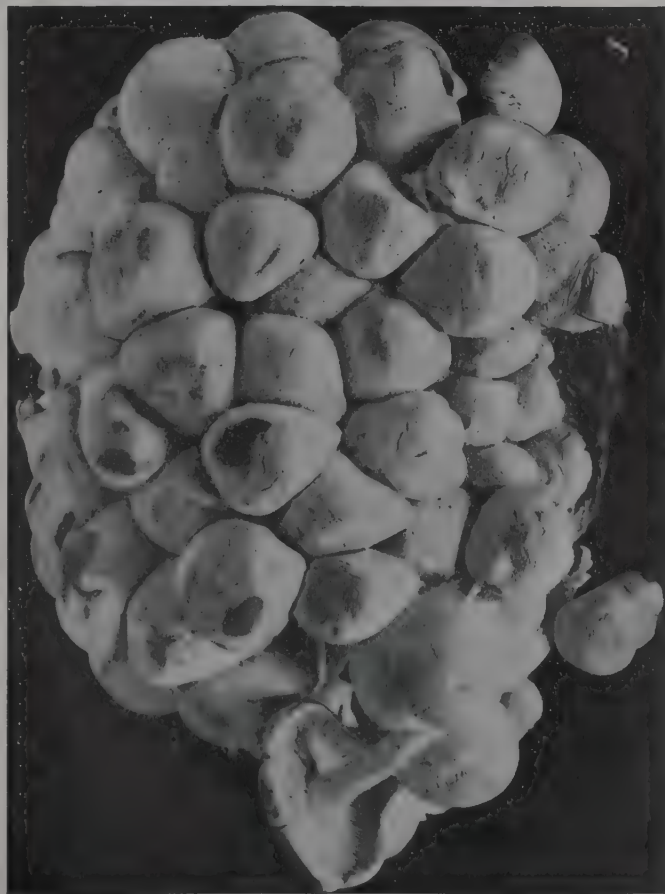
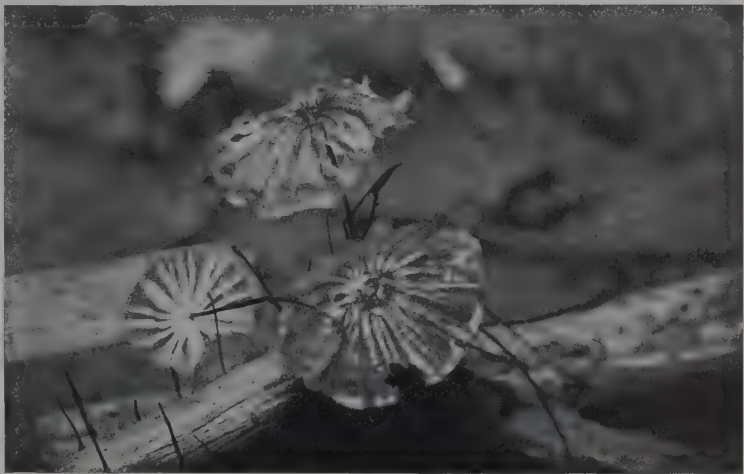
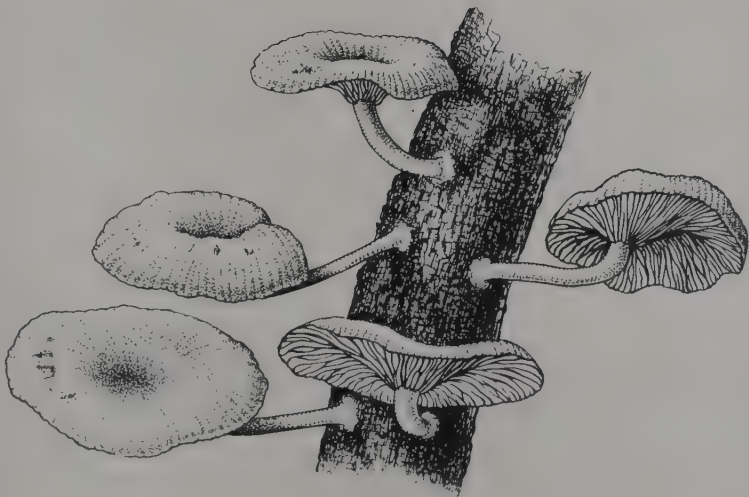


PLATE 33.



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PLATE 35.



PLATE 36.

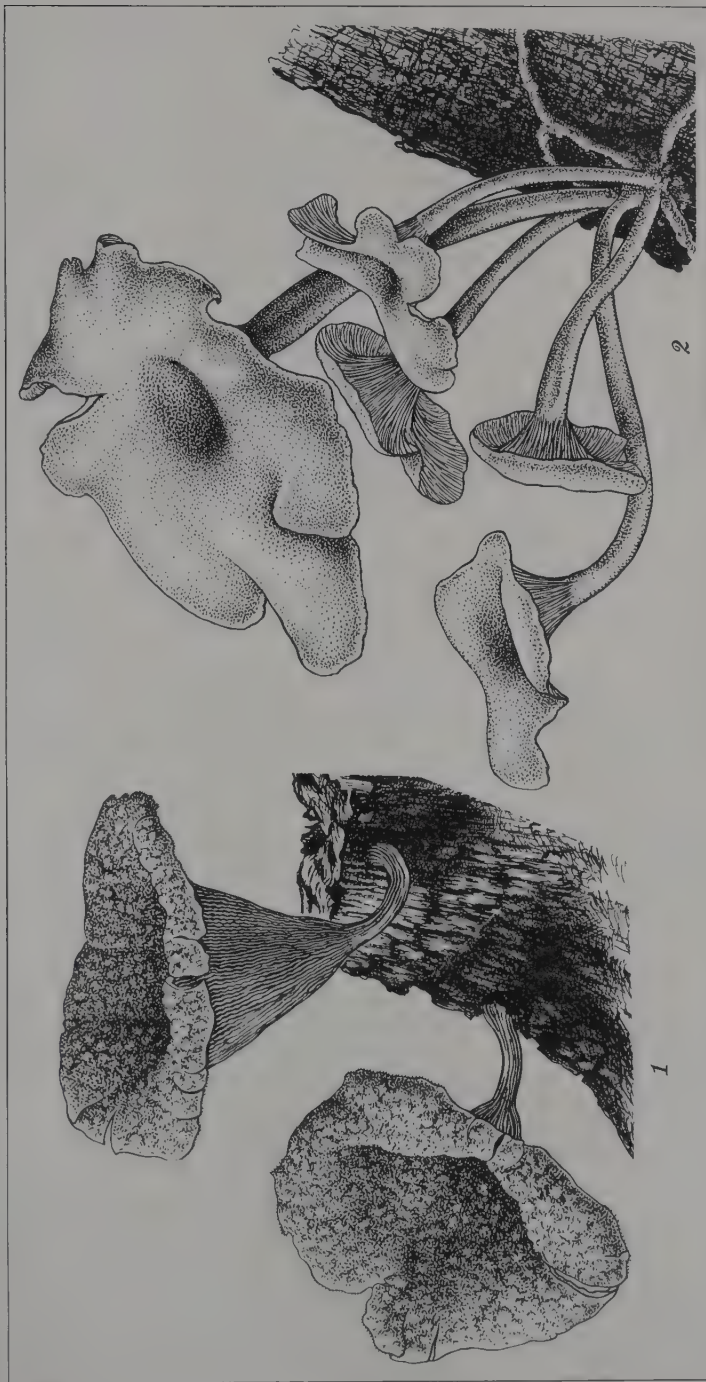


PLATE 37.



PLATE 38.

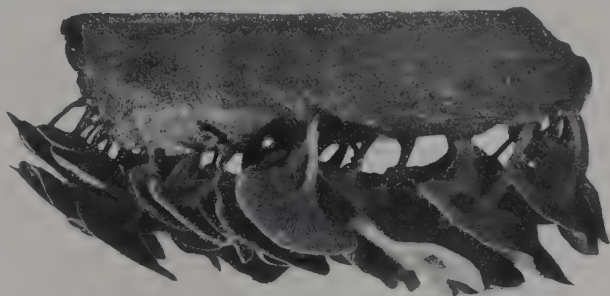
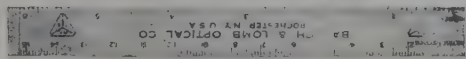
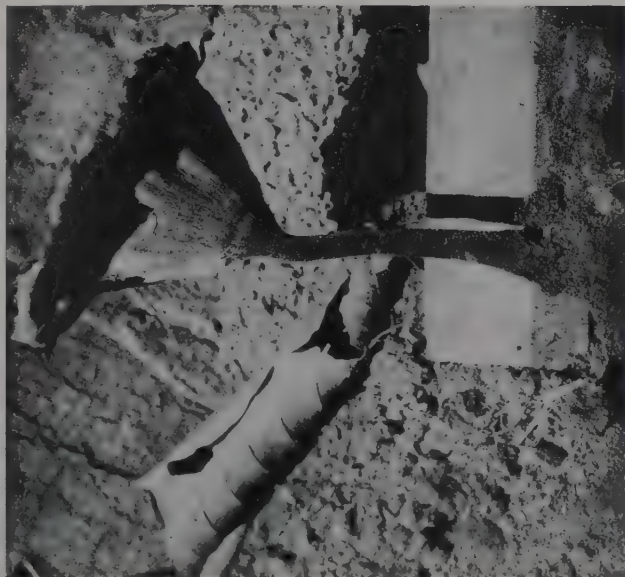
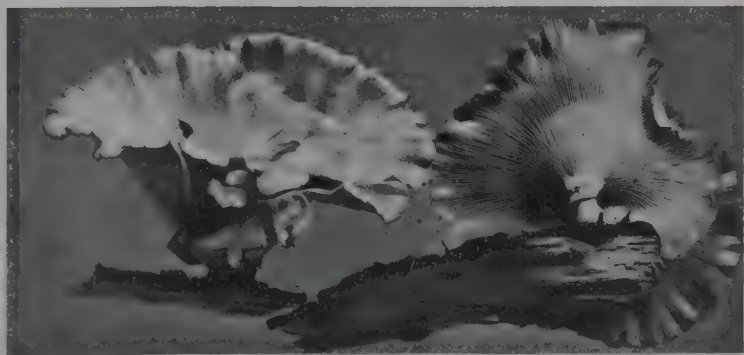


PLATE 30.



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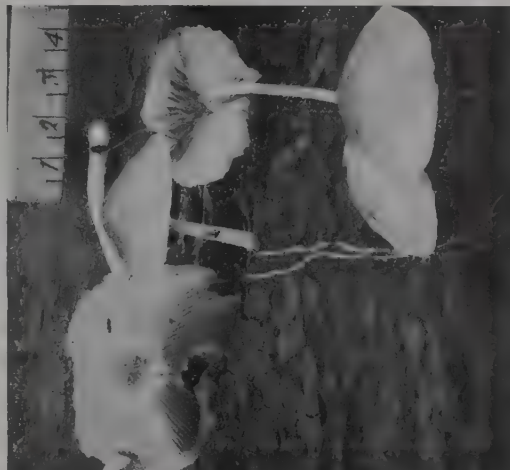
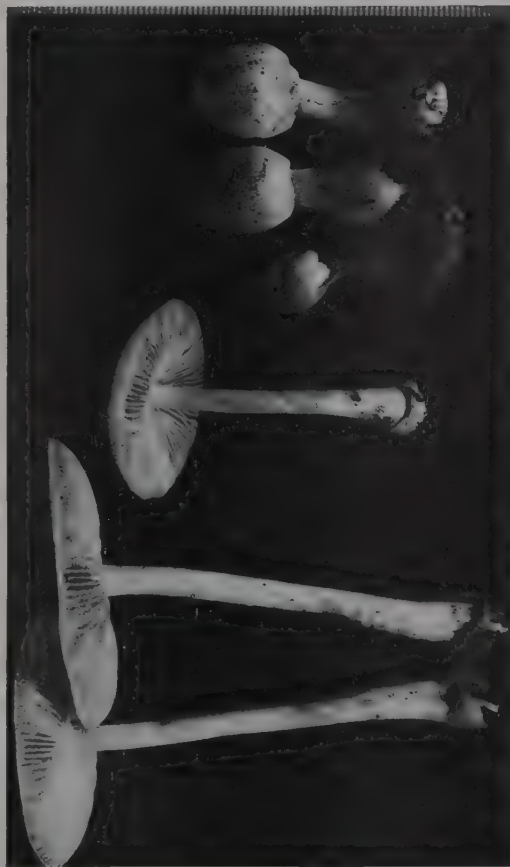
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PLATE 41.



PLATE 42.



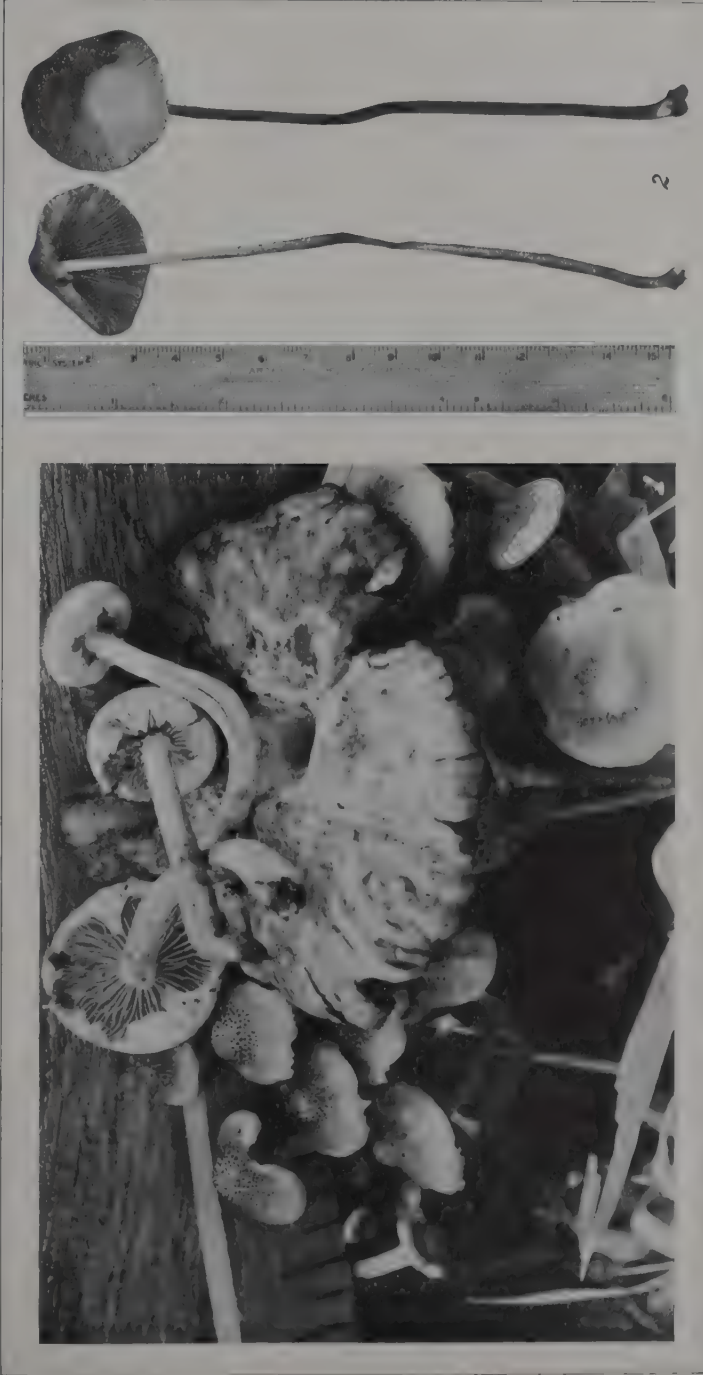


PLATE 44.



PLATE 45.



PLATE 46.

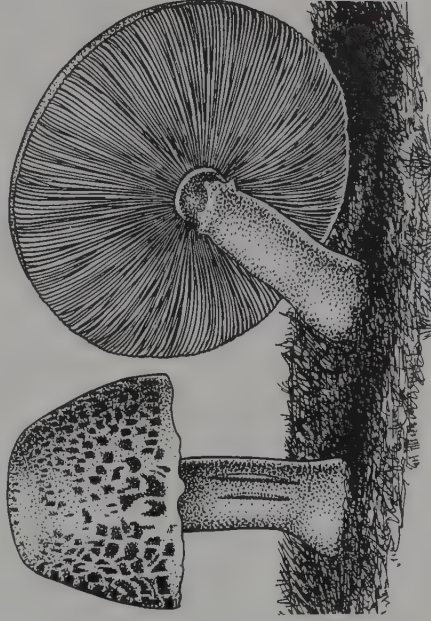
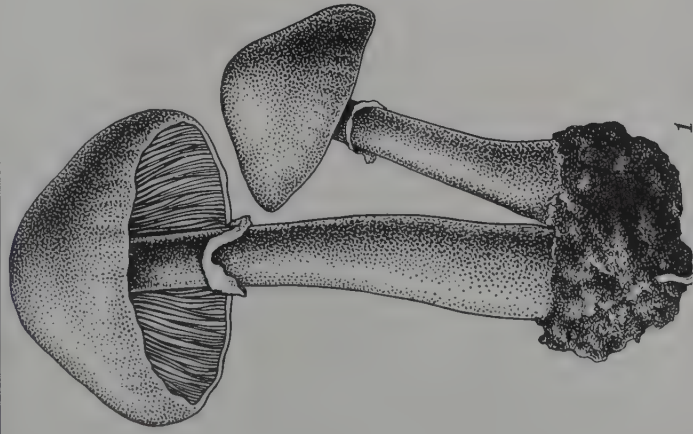


PLATE 47.

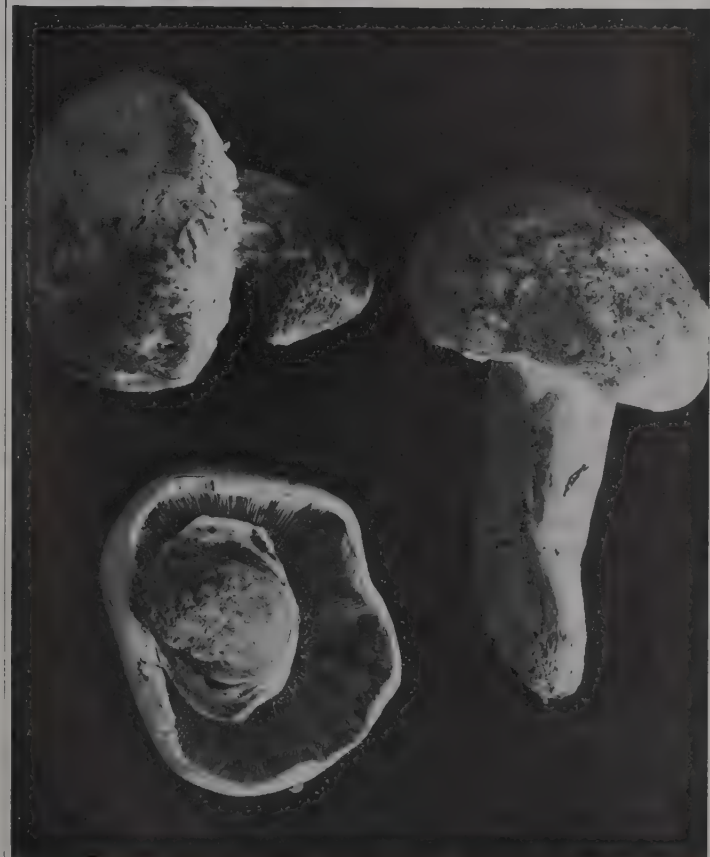
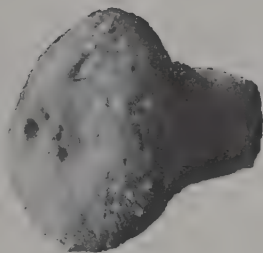
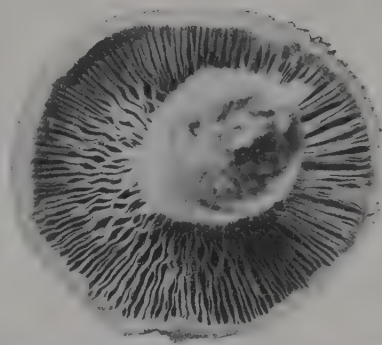


PLATE 48.



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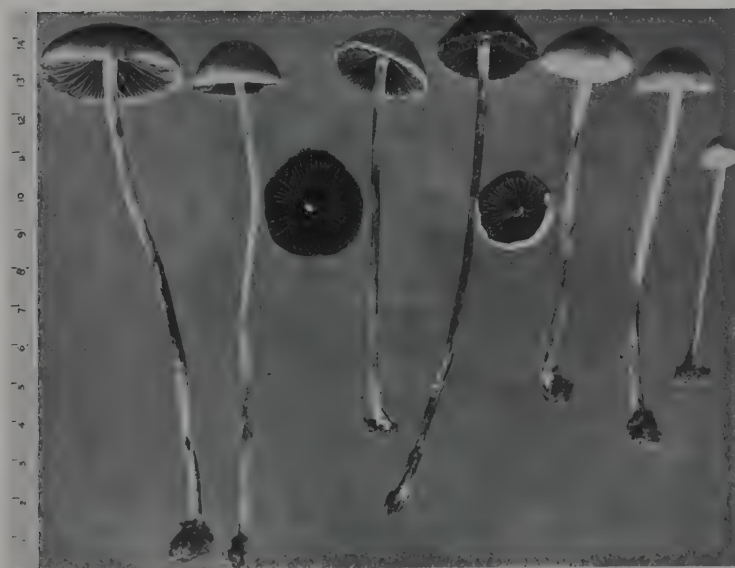
PLATE 49.



PLATE 50.



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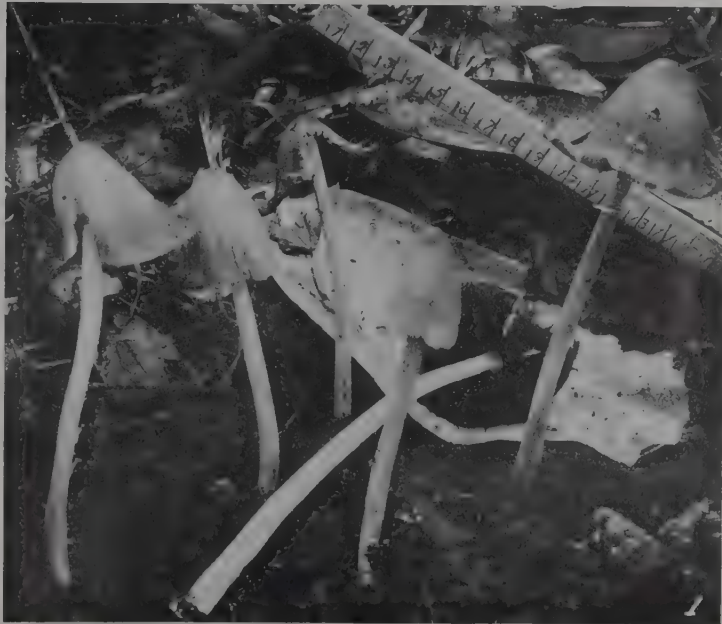


PLATE 52.

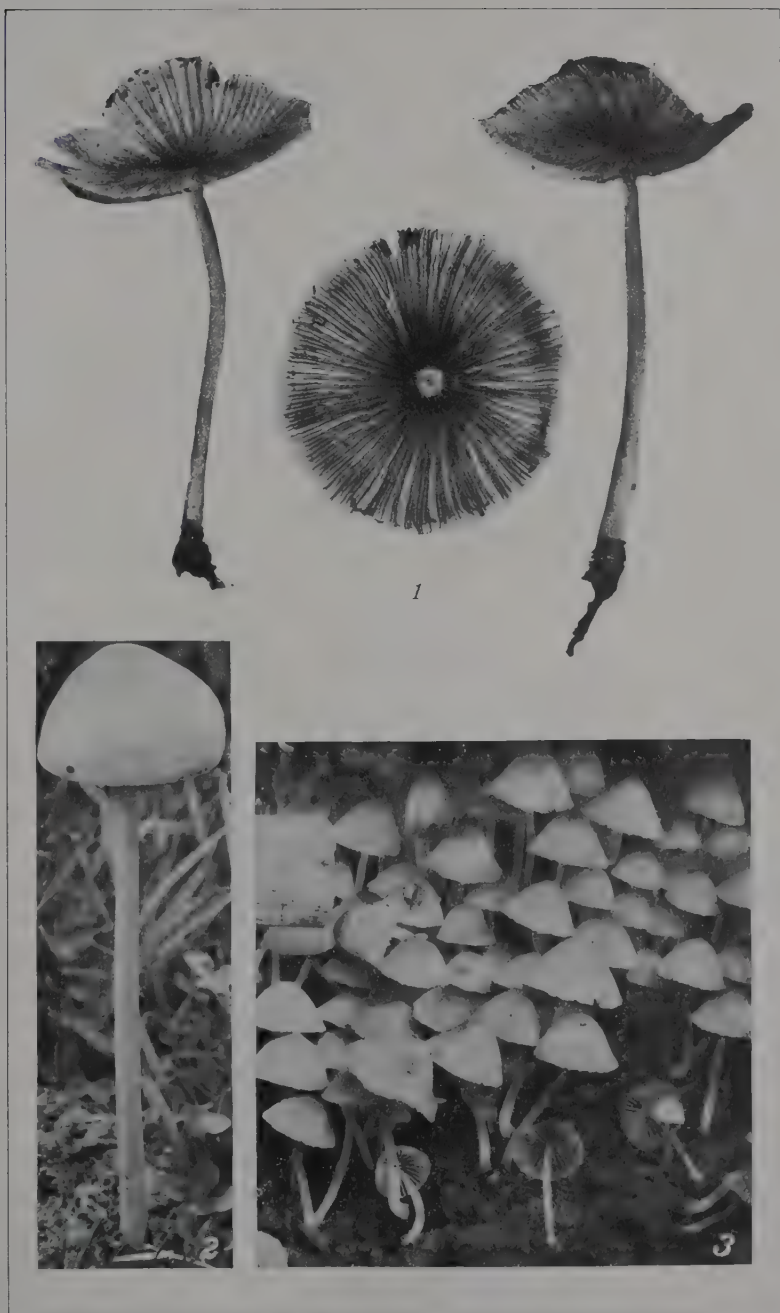


PLATE 53.



PLATE 54.



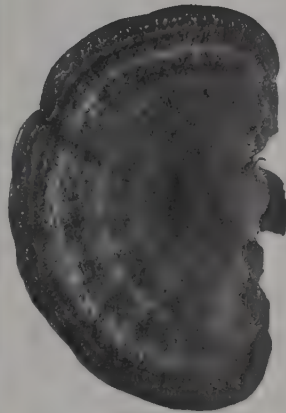
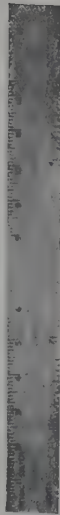
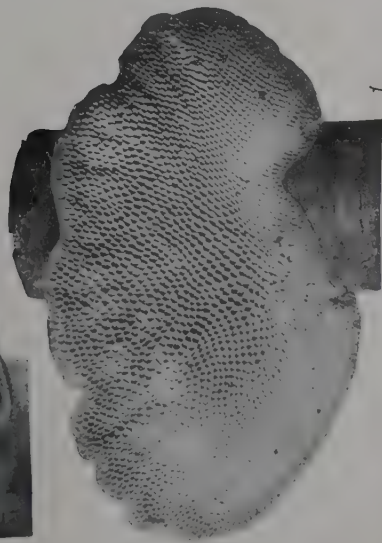
PLATE 55.



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PLATE 57.

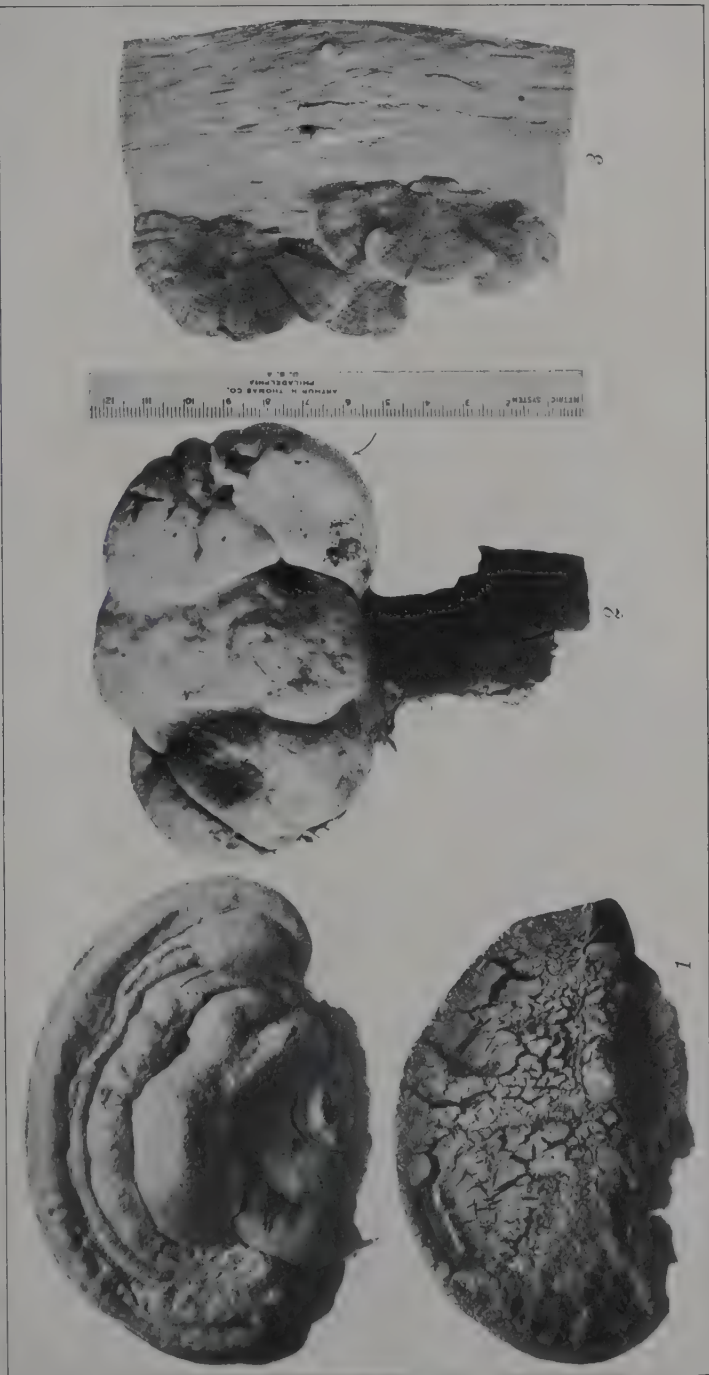


PLATE 58.



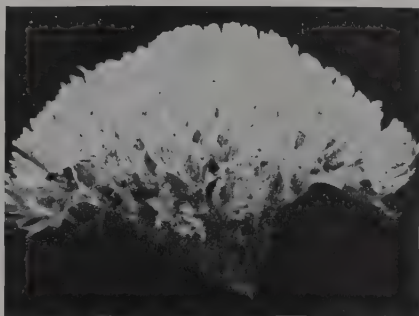
PLATE 59.



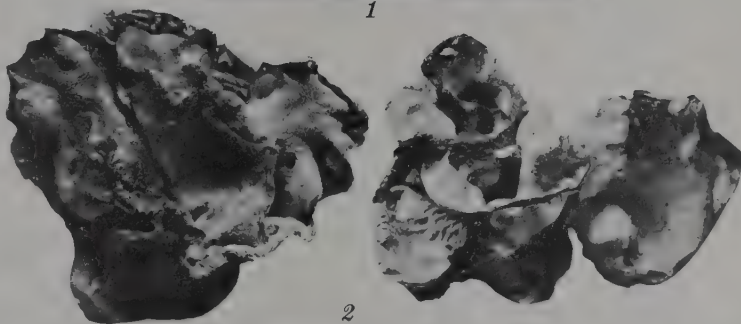
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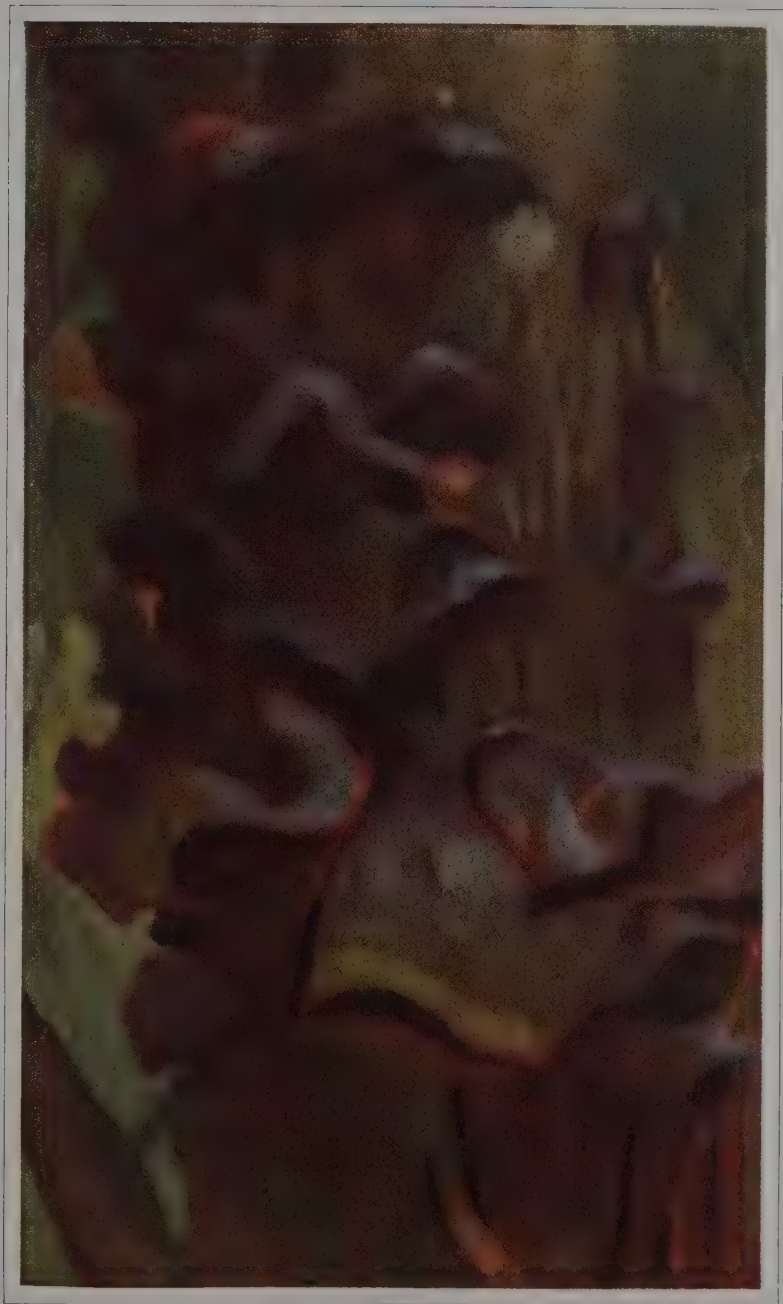


PLATE 62.

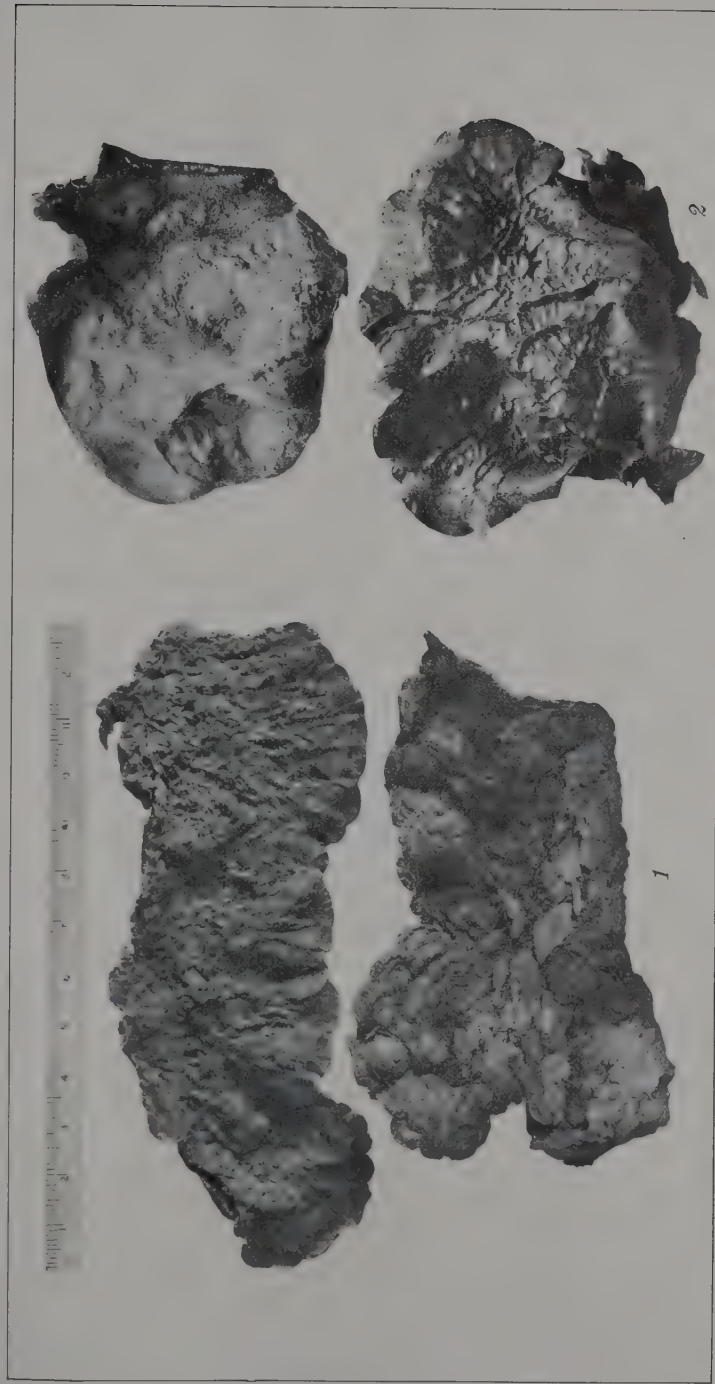


PLATE 63.



PLATE 64.



PLATE 65.



PLATE 66.

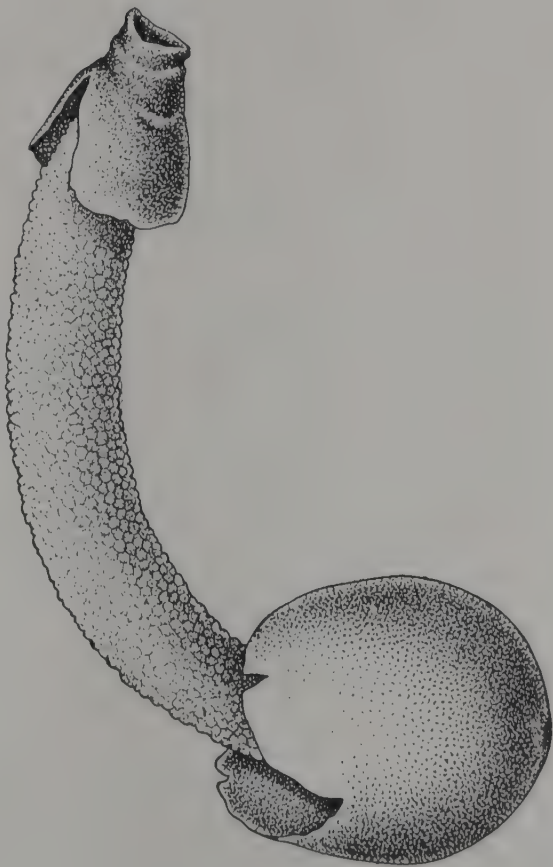


PLATE 67.



PLATE 68.



PLATE 69.

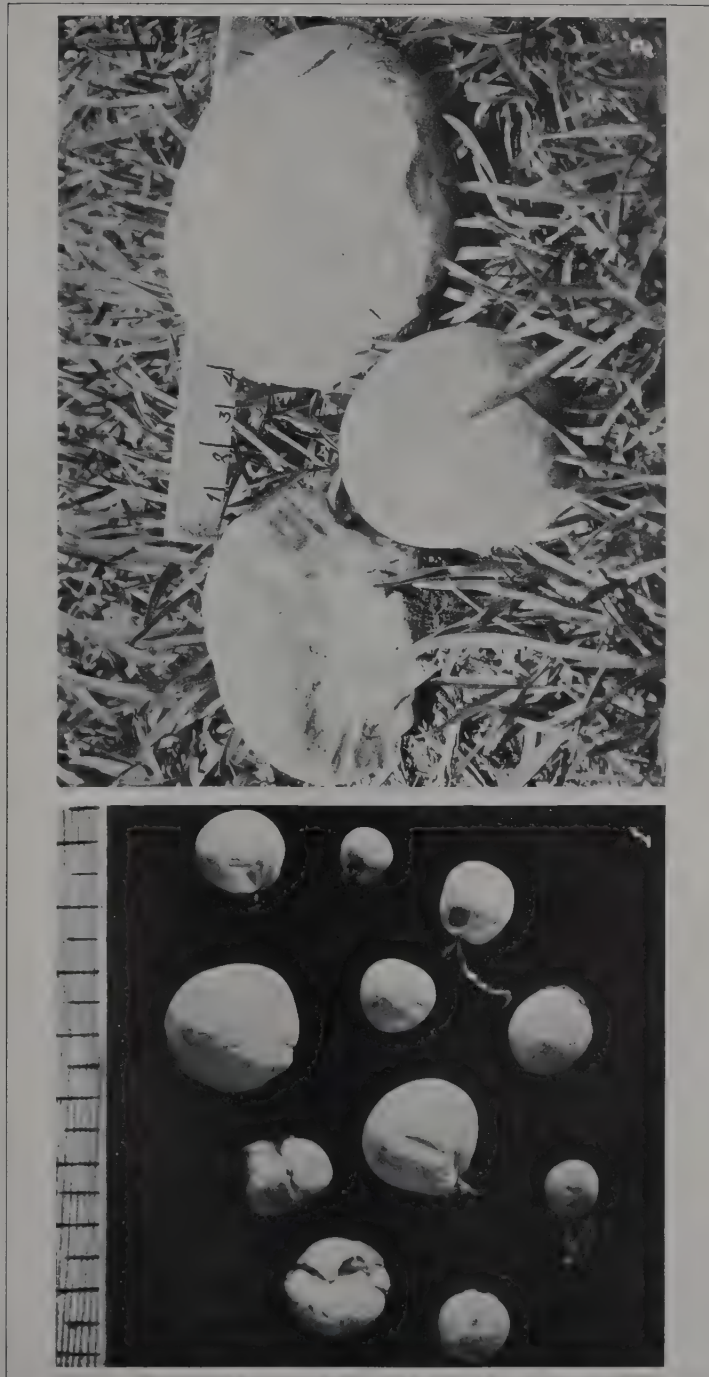


PLATE 70.

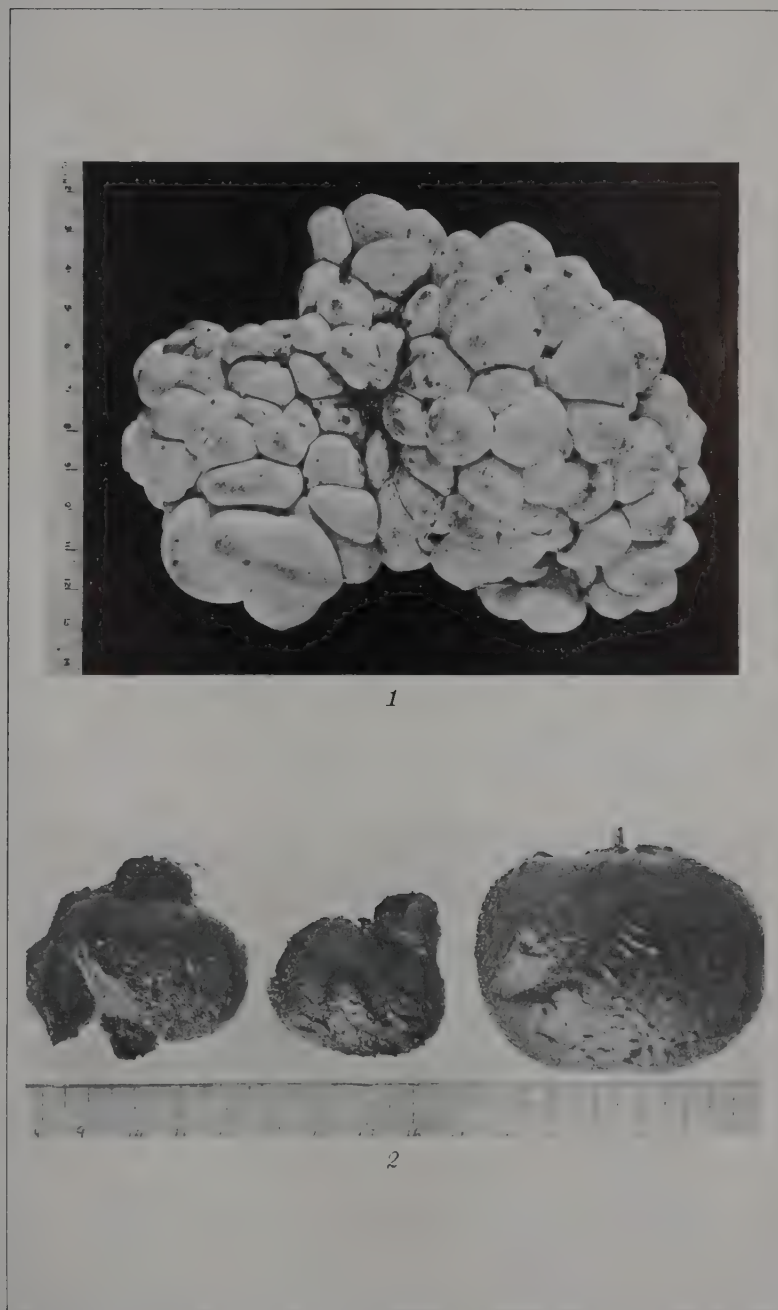




PLATE 72.



PLATE 73.

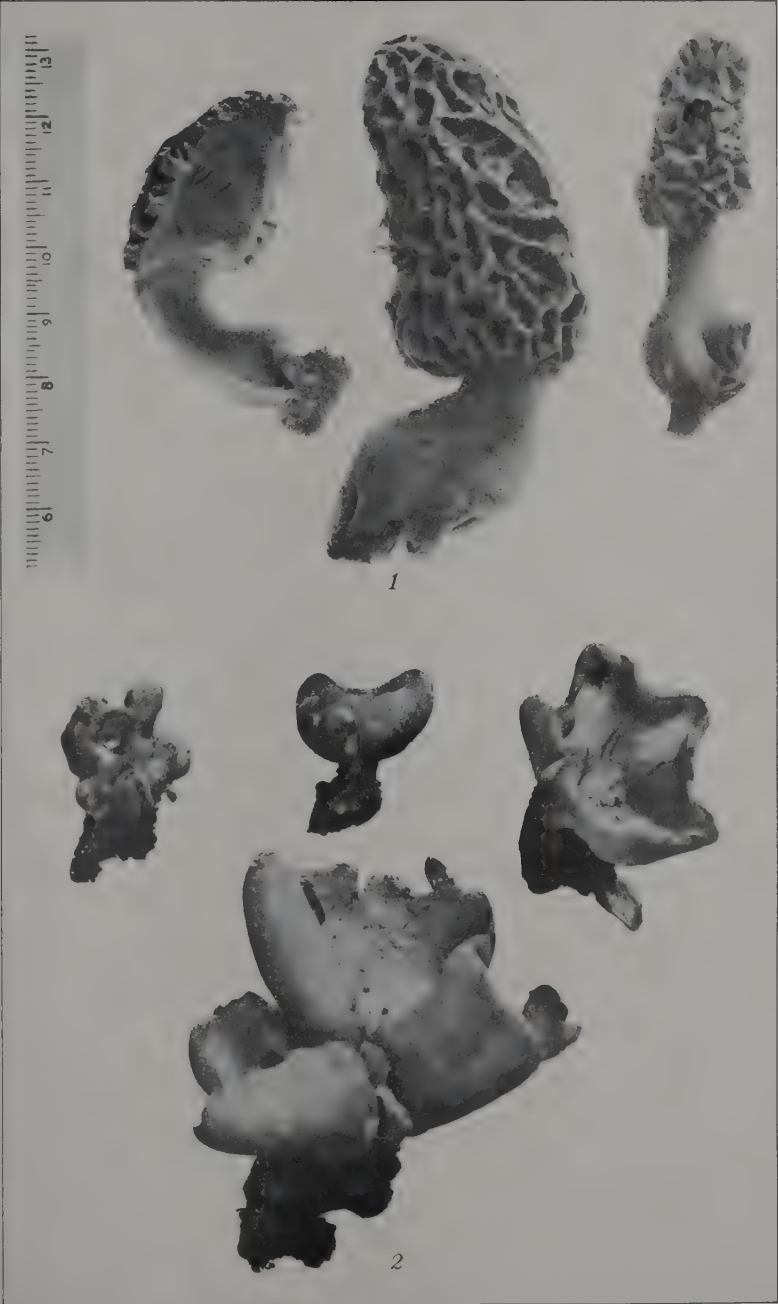


PLATE 74.

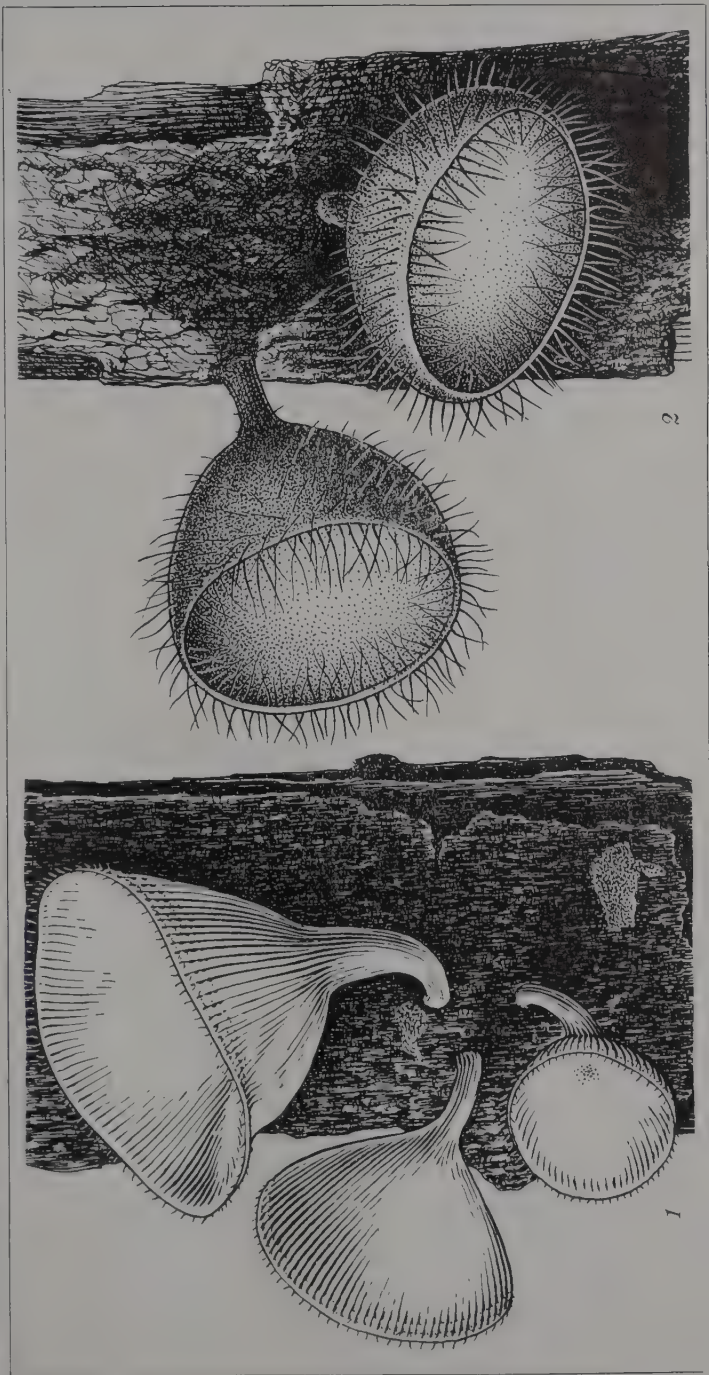


PLATE 75.



PLATE 76.

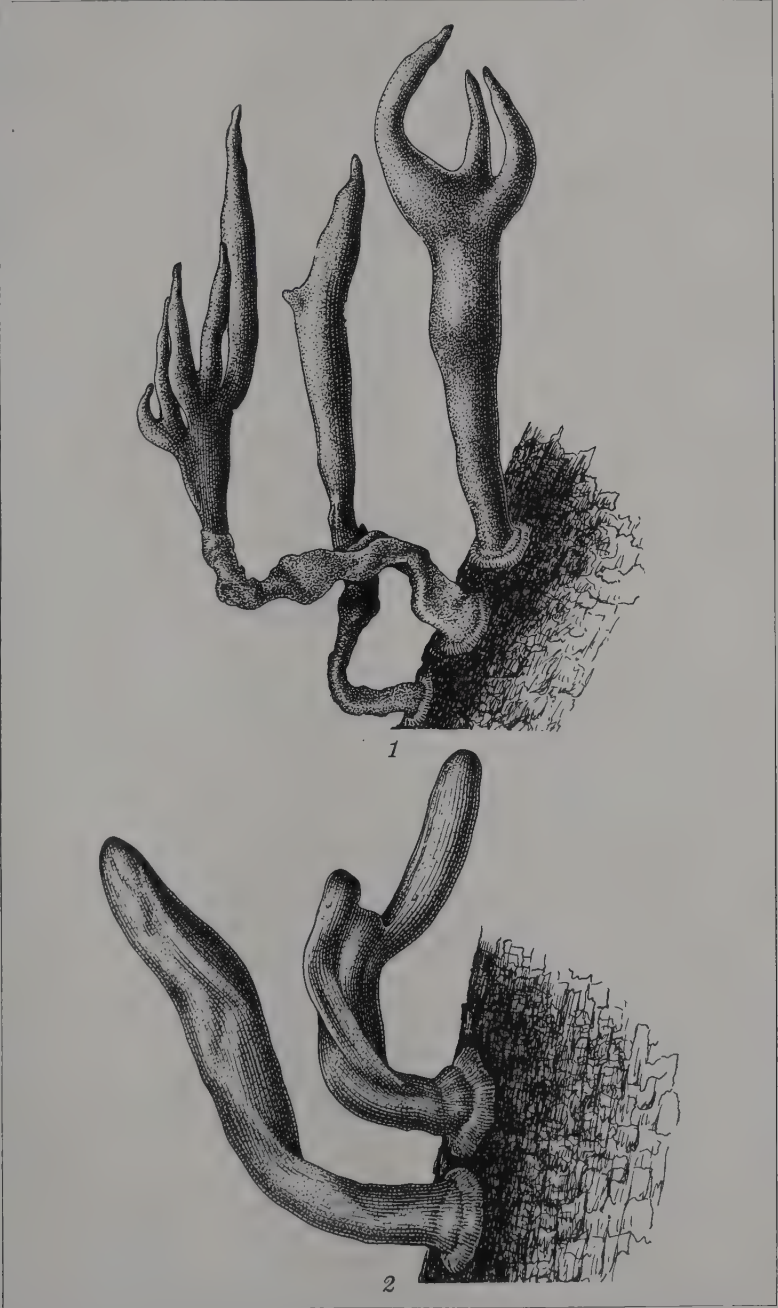


PLATE 77.

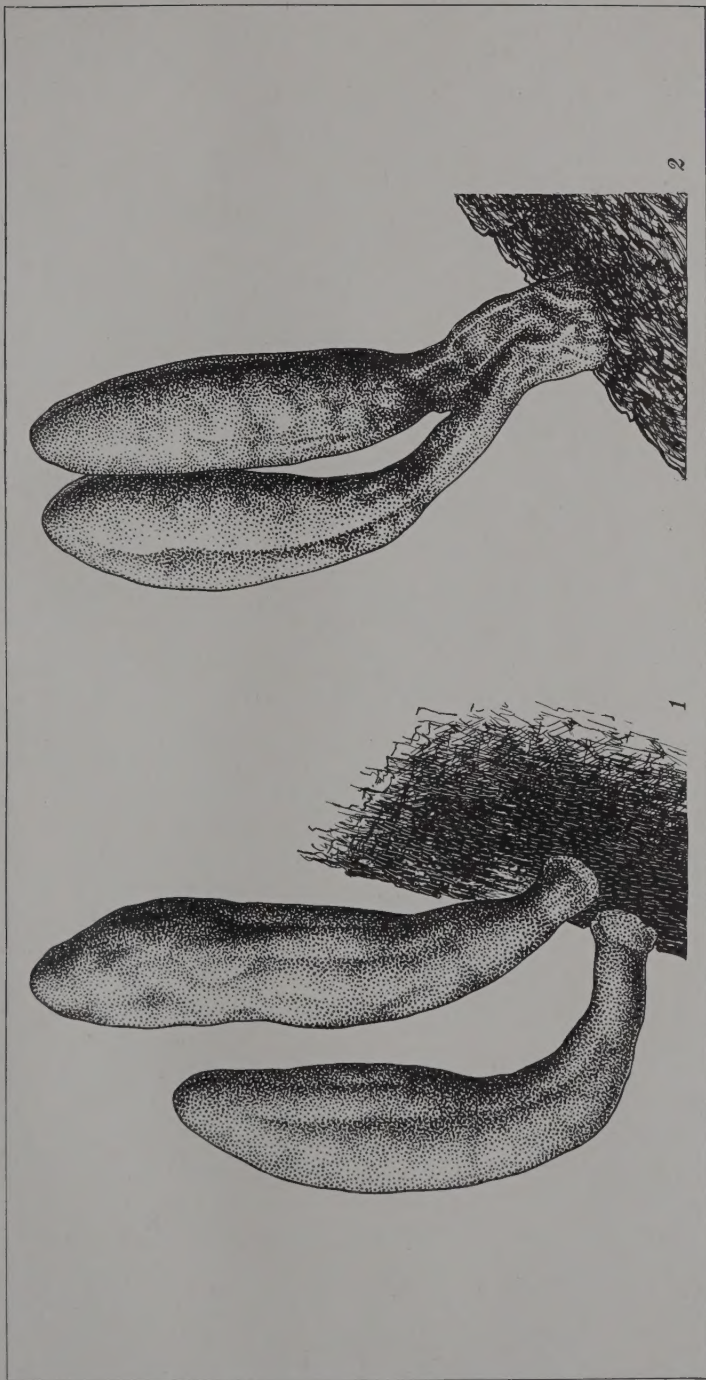


PLATE 78.



PLATE 79.

